MODERN DATA

JANUARY 1971

TECHNOLOGY PROFILES:

OPTICAL READERS AND OCR

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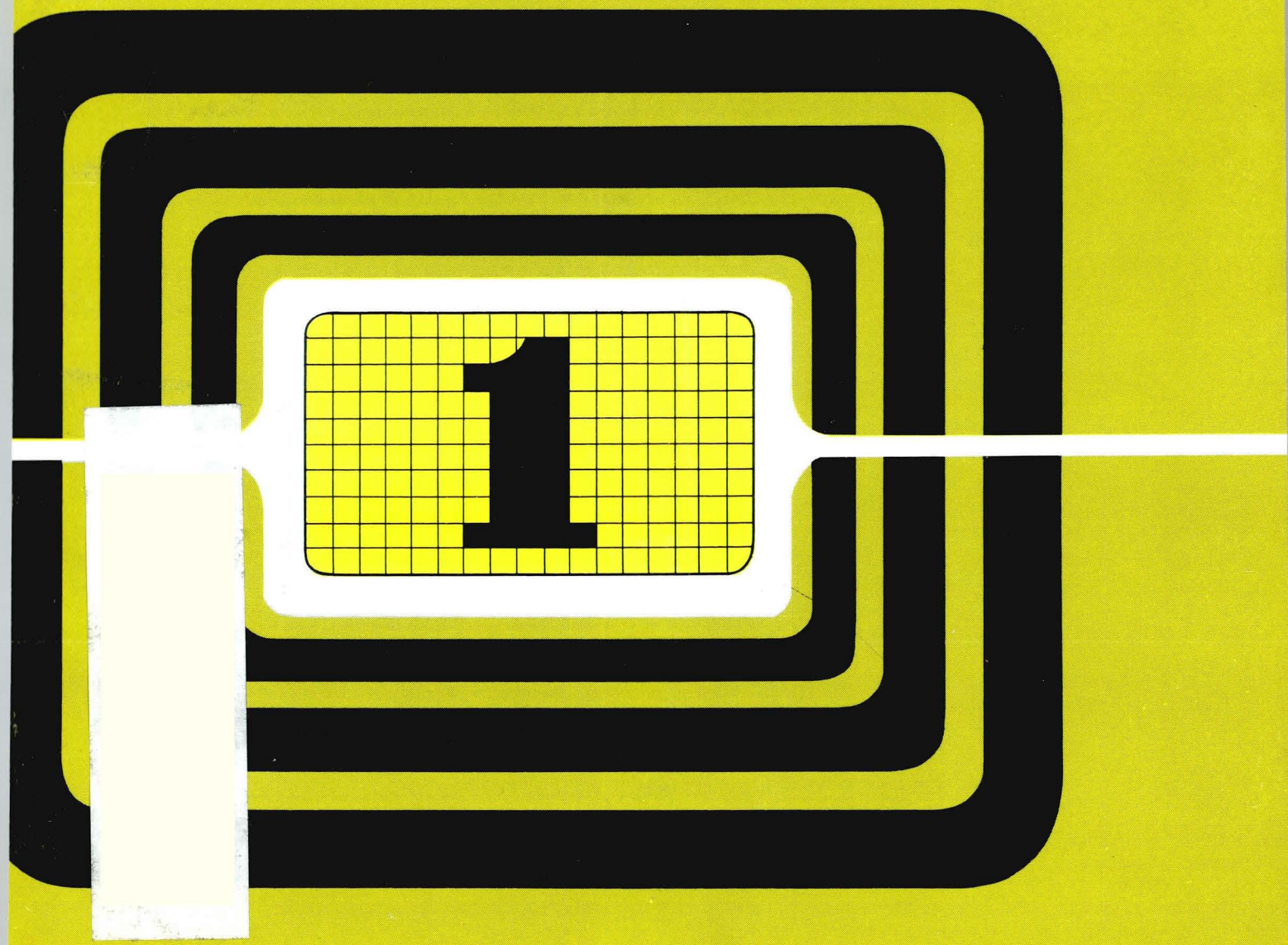

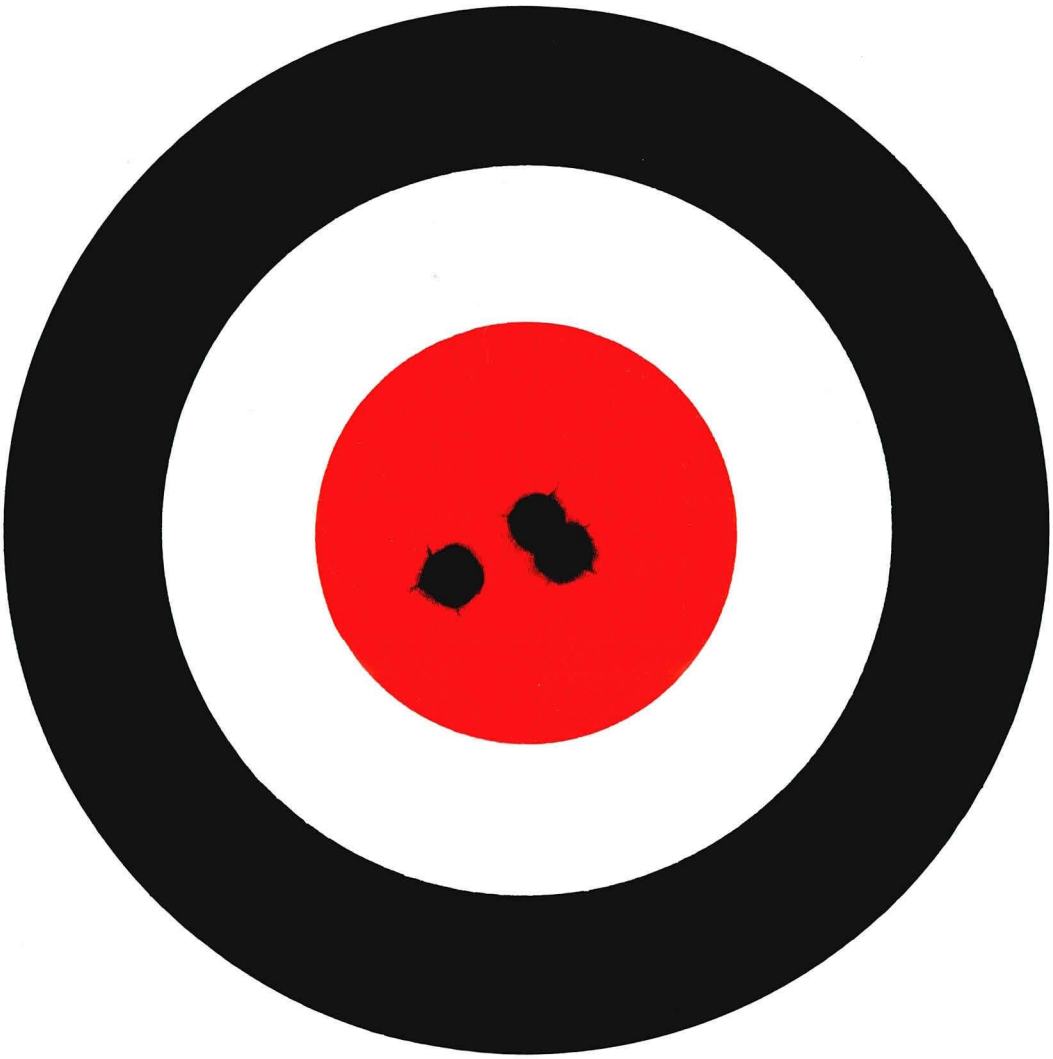

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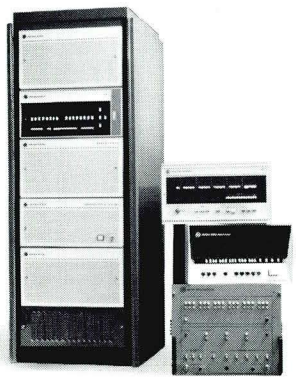

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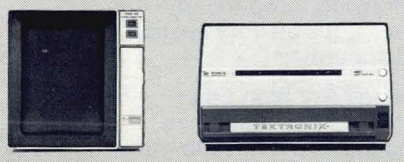

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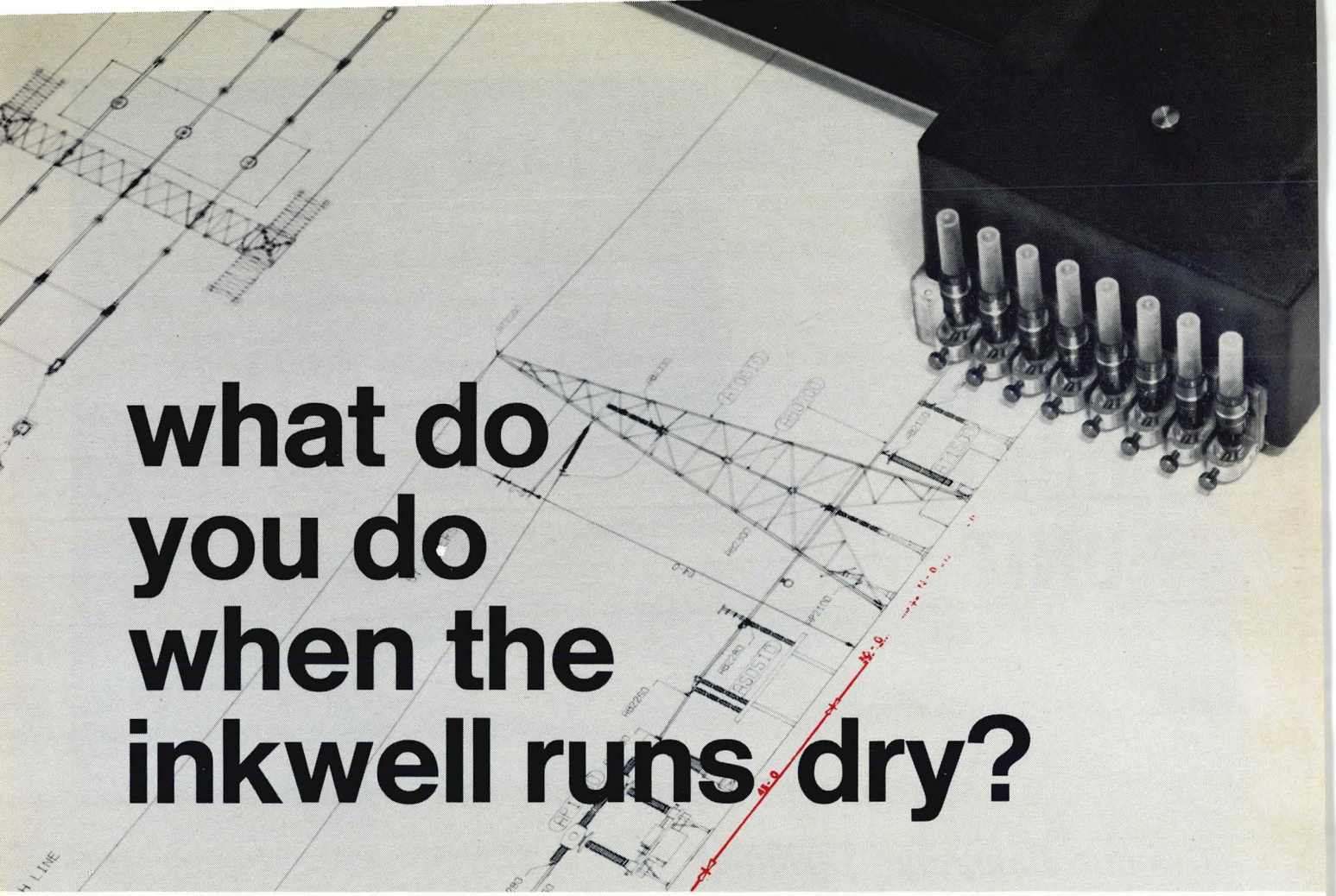

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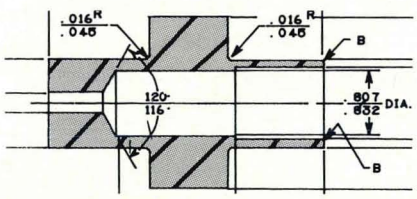

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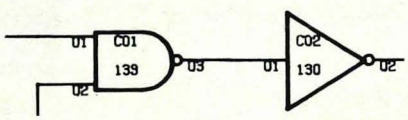

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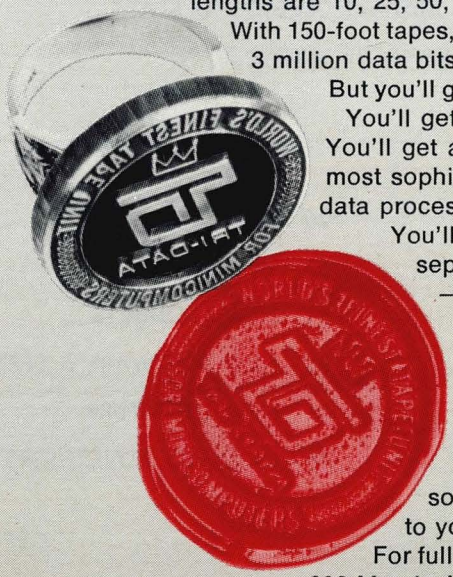

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CIRCLE NO. 6 ON INQUIRY CARD

LETTERS TO EDITOR

To the Editor:
In the 1970 October editorial, entitled "The New Science Advisor," wonderment was expressed about the extent of Dr. Edward E. David's competence in computers. This letter is intended to enlighten both your staff and your readers on this point.

In October 1968 the NATO Science Committee held the first conference on software engineering, at Garmisch, Germany. Attendance was limited to some 60 of the best known and most expert computer people in the world. I am sending a copy of the reports of this and the subsequent meeting to MODERN DATE for reference, for in my opinion they are classic documents, in content and style.

One of the major contributions to the first conference was Dr. David's "Some Thoughts about Production of Large Computer Systems." I have quoted from it more than once in my own papers. The quotation index is also illuminating. Using the count of quotations as a rough measure of influence, we find Prof. Alan Perlis was quoted most (26), Dr. David next (25), A. G. Fraser (20), Ken Kolence (17), the late Ascher Opler of IBM (15), and so forth. Certainly reading these quotations and talking with the conference attendees would be convincing proof of Dr. David's deep understanding of computers and, in particular, software.

On another point in the same paragraph, I insist that Bell Telephone Laboratories **are** a leading influence in the computer industry. Show me another computer manufacturer (they are, you know) that produces hardware and software which together do not have more than two hours downtime in 40 years!

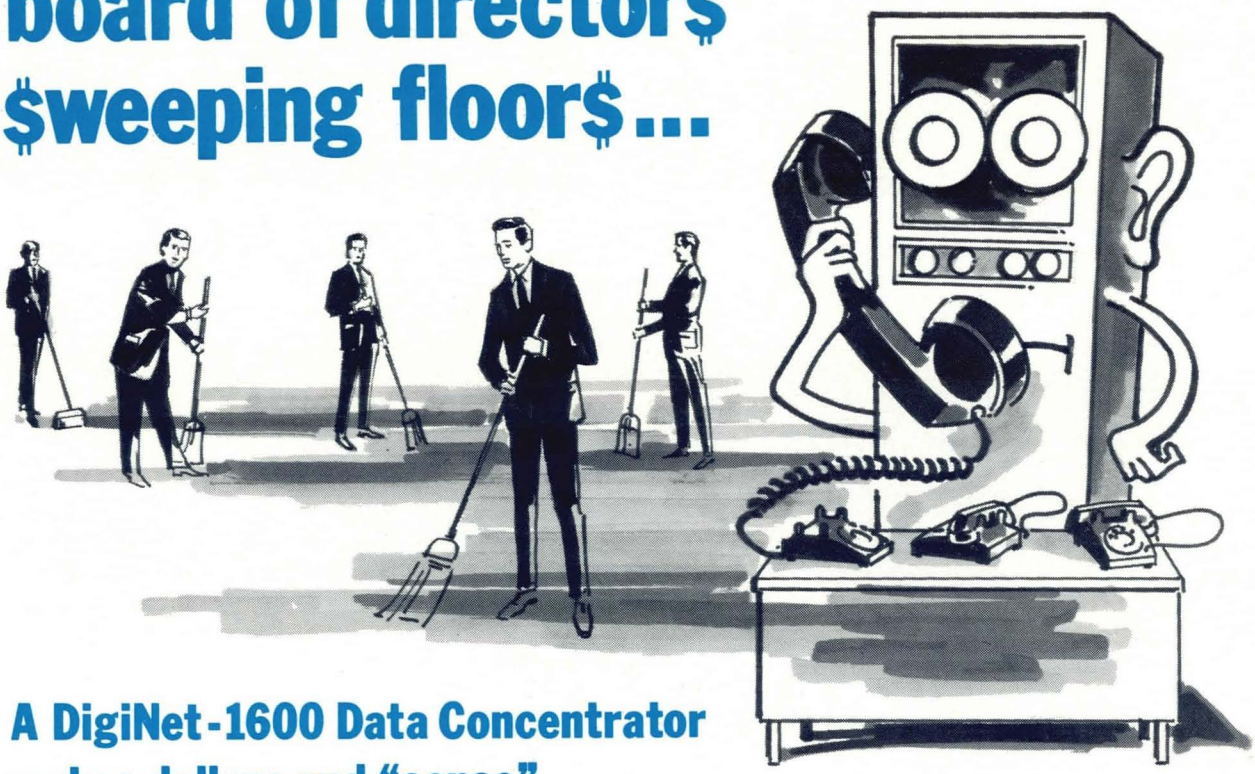
One of Dr. David's responsibilities at Bell Labs was the Picturephone, and isn't that a computer terminal? I should mention also that he was the original Chairman of the Communications Sector for the ACM '70 Conference, at my request, and resigned only because of an overload of commitments, one of which may have been to prepare for this new assignment.

I think our industry should be grateful that Dr. David has been assigned to this most influential position, not because he has been in part a "computer expert," but because computer exposure has sharpened his insight for systems trade-offs. That's what you need when you are short on resources and time, as this Earth is.

R. W. Bemer
Honeywell

The Editor's Reply: Mr. Bemer has *made a valuable contribution to all of us by documenting Dr. David's credentials, which were, however, never in doubt. Also, I share the sentiments which Mr. Bemer expresses in the concluding paragraph of his letter.*

your computer an$wering phone$ make$ a$ much ene a$ your board of director$ $weeping floor$...



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It'll help keep line costs down (by consolidating as many as 256 terminal inputs for transmission over a minimum number of voice-grade lines). . . It'll free your computer to do more computing (it speaks in 16 bit words and has a 4k to 32k memory to assemble blocks of data before re-transmission to the computer or the addressed remote terminals). . . It'll eliminate the need for external Modems and Multiplexers (these are plug-in options in the DigiNet-1600).

——And it'll do much, much more!

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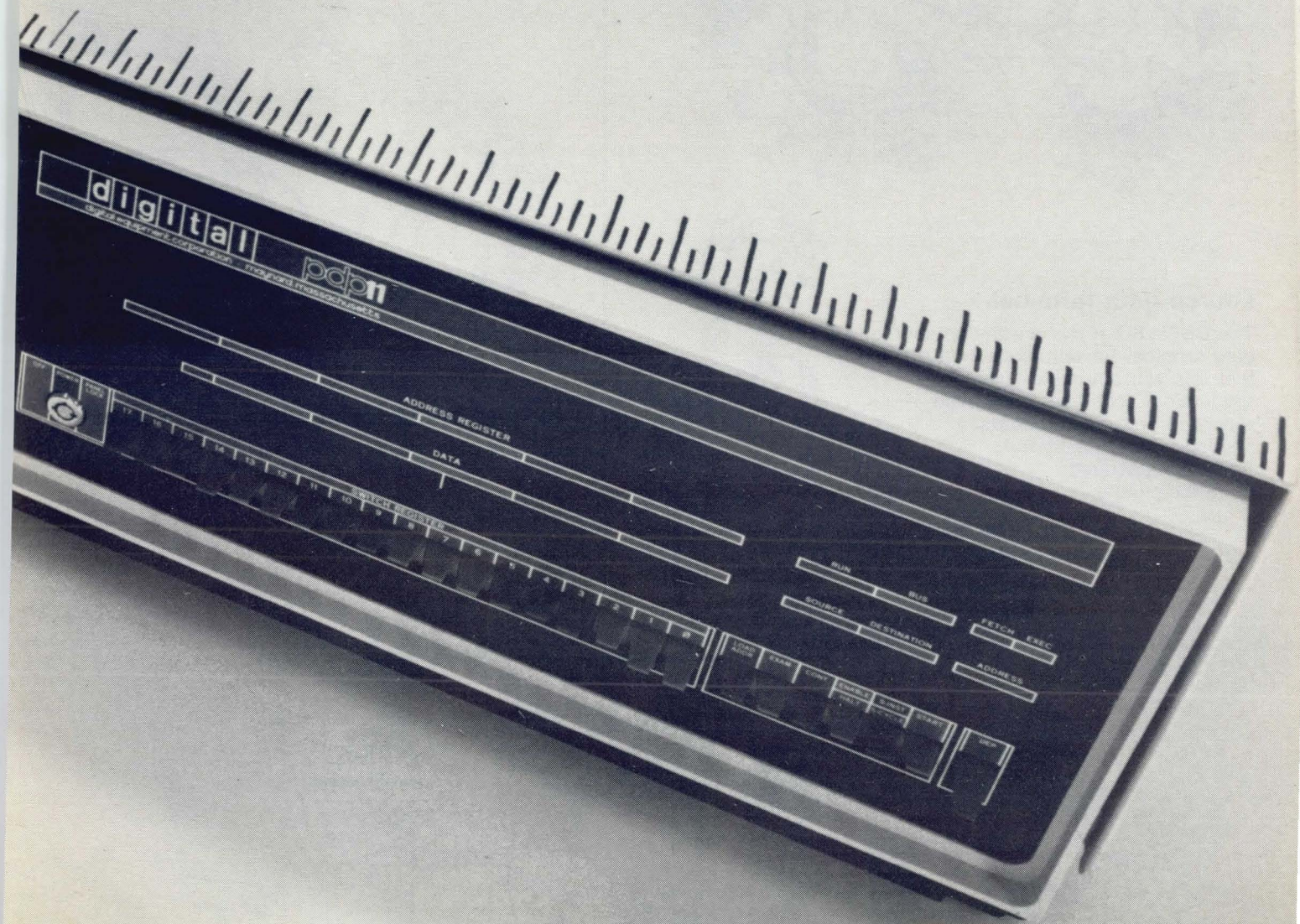
To find out how much more a DigiNet-1600 Data Concentrator can do for your digital network, write Section 12, Telecommunication Products Department, General Electric Company, P. O. Box 4197, Lynchburg, Virginia. . . .Your full line supplier of DigiNet Data Communications Equipment and Systems.

GENERAL ELECTRIC

rdsticks



CIRCLE NO. 9 ON INQUIRY CARD

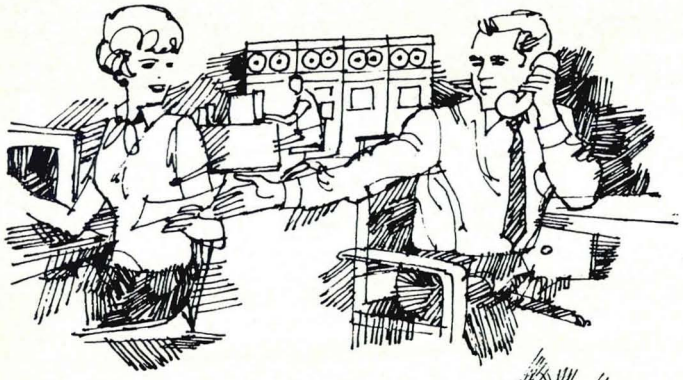
terminal operations controller

T.O.C.S. *starts* with the CDC® 20290 Multistation Controller. This device interfaces directly to the Selector Channel; handles the chores of polling 12 independent ports for inbound data traffic . . . directing outbound messages . . . performing EBCDIC-device code translation.

T.O.C.S.

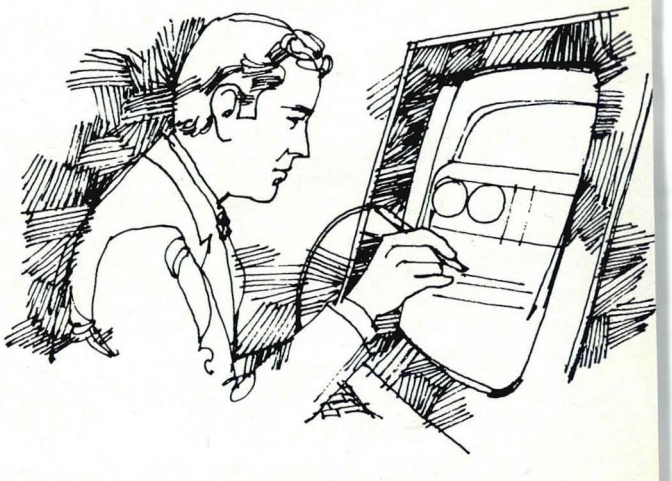
multistation controller

CDC's 20290 Local Controller and 216 Remote Controller will support CRT displays, typewriters, hardcopy recorders and line printers in any combination. Permits the high-volume data entry and retrieval operations demanded by on-line management systems.



graphics subsystem terminals

Control Data can provide a versatile family of remote graphic terminal subsystems. Included among them is CDC's GRID™ which incorporates its own computing capability, and can be remoted from the central site via 201-A or -B, or 301 Modems.



source data terminal

The CDC® SD-101 is an on-line source data terminal for data-collection systems that lets you automate inventory, production, schedules, cost/time reporting and other records needed to keep plant and office management up-to-the-minute.

remote batch terminals

Control Data offers you a choice of remote batch terminals that will handle a variety of peripherals in line speeds from 2000 bps to 40.8 kb.

TERMINAL OPERATIONS CONTROL

. . . a unique cost-saving way to expand your EDP capability without getting "sold-up" to a bigger CPU

Now — get far more from your existing computer — spare yourself the expense of going to a bigger mainframe. CDC® T.O.C.S. is the versatile new "Terminal Operations Control System" that offers *a simpler, more efficient answer* to controlling local and remote terminals within your communications network *with faster transfer rates throughout!* Compatible with major computer system mainframes including IBM 360, T.O.C.S. actually takes over many routine communications housekeeping chores, clears the way for more profitable use of your central processor.

Speeds communications . . . expands channel capacity

Much of T.O.C.S.' enormous gain in efficiency is due to its versatile multistation display controller that handles functions such as polling for inbound traffic . . . directing outbound messages . . . EBCDIC-code translation . . . and other tasks that would unnecessarily burden your CPU.

T.O.C.S. software accommodates Control Data's entire family of terminal systems. Handles any combination of single or multistation CRT displays, typewriters, hardcopy recorders, line printers, and communication-line pollers. Supports both local and remote terminals and communication lines . . . regardless of mix or number — right up to practical load limits for the line, channel and your applications software. The controller interfaces directly with the Selector Channel at 59,500 characters per second.

Control Data's cost cutting total-systems approach

T.O.C.S. adds up to one of the most complete lines of *fully operational* terminal-control hardware/software packages available. So you get precisely the system you need . . . at *single-source* savings. Shown here are just a few of the many terminal options available to you.

From the world's most powerful computers, to people-oriented terminal systems, Control Data *means* cost saving efficiency . . . compatibility that only a total systems supplier can provide. CDC has the hardware, the software, everything you need from engineering services to set-up, operator training, documentation and support.

For more information on T.O.C.S. and a copy of our new brochure, "Terminal Operations Control Systems," just call our HOT LINE collect.

HOT LINE 612-884-8195
Or if you prefer, write directly to:
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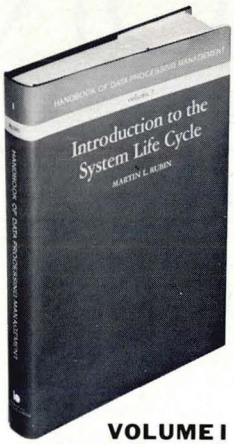

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3. System Design
4. Programming
5. Documentation
6. System Installation
7. System Operation

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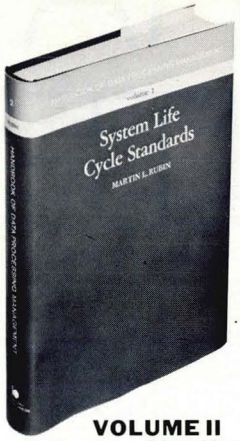

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System Life Cycle Standards

1. Project Management
2. Preliminary Analysis – Investigation
3. Preliminary Analysis – Systems Proposal
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6. Systems Design – Specifications
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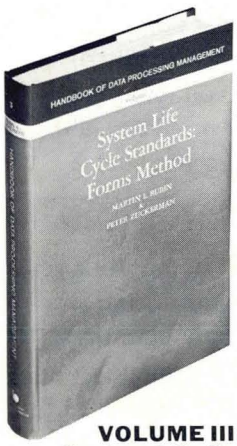

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6. Operations Documentation
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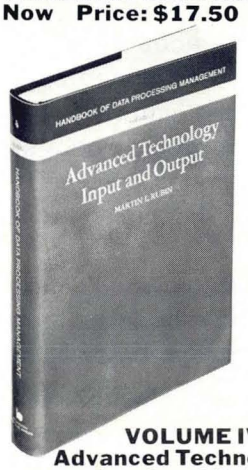

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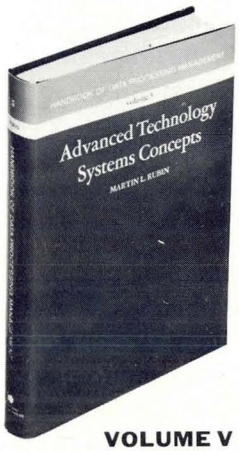
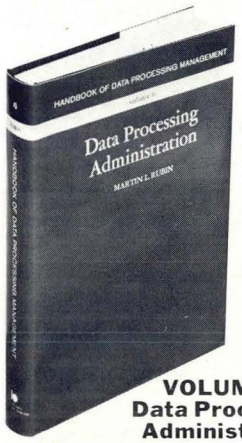


VOLUME V
Advanced Technology – Systems Concepts

1. Data Transmission
2. Online Systems
3. Data Base Concepts and Considerations
4. Machine Self-Management
5. Management Info Systems
6. Computer Models and Planning
7. Cybernetics and Data Processing

Publication Date: February, 1970 Price: $29.95



VOLUME VI
Data Processing Administration

1. Data Processing Organization
2. Data Processing Personnel Policy
3. Data Processing Education
4. Legal Considerations in Data Processing
5. Acquisition of Computer Power
6. Management of the System Life Cycle Stages
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Years in the making, Handbook of Data Processing Management is a compendium embracing every stage of this difficult art—from the first conception of a system to preliminary analysis, system design, programming, documentation, installation, operation and, finally, cessation.

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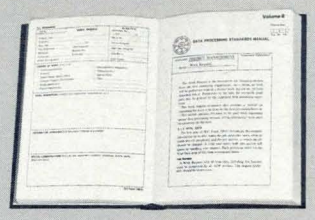

As a result, Handbook of Data Processing Management is the most useful, most valuable reference work ever created for the EDP executive. The forms in Volumes II and III alone would cost hundreds of thousands of dollars if you had to originate them yourself.

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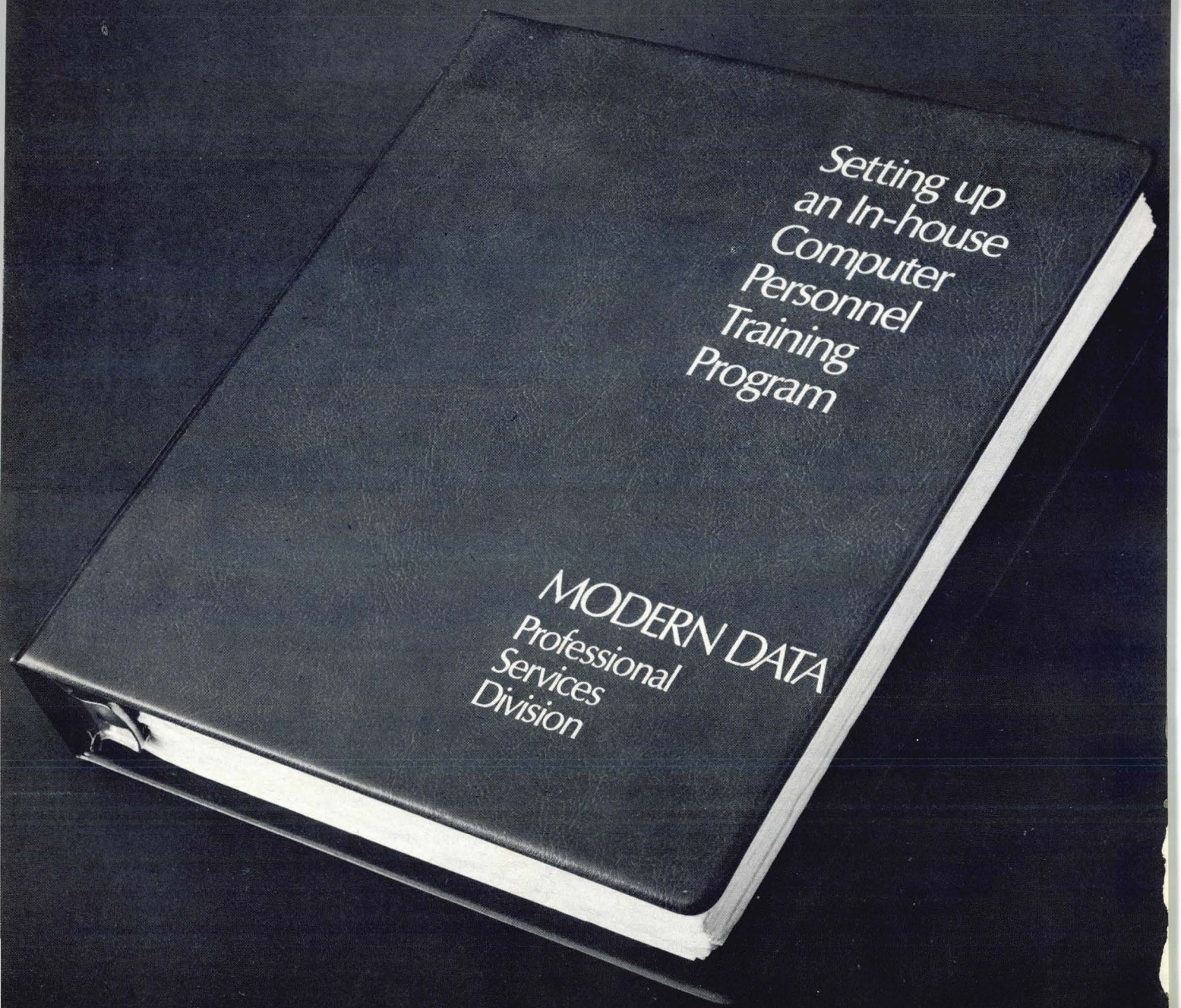

Written for the Modern Data GEM Report by Oyer Professional Computer Services, this 250 page indexed volume offers a complete systems approach to training. It is offered to you on a 10 day trial period for just $150.

This Modern Data GEM Report shows how to:

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- Train the non-EDP professional
- Develop your own courses without incurring high consulting costs
- Transform poor installations into good installations
- Good installations into excellent installations
- Excellent installations into outstanding ones.

TABLE OF CONTENTS

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NEWS ROUNDUP

THE NUMBERS GAME

Peripheral Equipment Corp. states that so far it has been unsuccessful in getting IBM to clarify remarks made in July to the Business Equipment Manufacturers Association regarding a totally new magnetic tape cassette system "completely incompatible with anything that has gone before." PEC believes IBM didn't just pick a ¼-inch, 4-track, 1600 cpi, 340-foot-per-pack standard out of thin air. Says PEC marketing director Geoff Taylor: "The industry and our company is once again hung up while we await IBM's pleasure. All we can do is appeal to the public forum to emphasize the urgent need for a broader disclosure of the proposed mechanical configuration. This would benefit the whole EDP industry by enabling manufacturers to build-in an adequate degree of product compatibility with IBM's *de facto* standard. It's funny what merely mentioning numbers can do, especially if it's IBM doing the mentioning."

IBM/MEMOREX LAWSUIT

IBM has instituted a lawsuit against Memorex Corp. charging wrongful appropriation and use of IBM trade secrets and confidential information. The action seeks to enjoin Memorex and Peripheral Systems Corp., its wholly-owned subsidiary, "from continued use of IBM trade secret information" and "from seeking to hire IBM employees for the purpose of obtaining confidential information." Memorex rejects the charges as "groundless" and a reaction to Memorex's "success in replacing IBM's equipment in many of its customers' installations."

MAJOR ADDITIONS TO UNIVAC 1100

A new roof to its 1100 series, new hardware and software expansions to a lesser 1100-series member, an independent communications processor, and four new peripherals were announced simultaneously by Univac. The biggie is the Model 1110, described as 3 to 5 times more powerful than the 1108, Univac's previous (and very successful) top-of-the-line. The 1110 uses plated wire main storage to achieve 320 nsec read and 520 nsec write speeds (per 36-bit word) with approx. ¼ to 1 million words of 1.5 usec (full-cycle) conventional core storage. The 1110 will be available in a wide variety of configurations in late 1971 at prices upwards of $2 million. The remaining announcements were: an 1106 multiprocessor system; an 1106 disk resident version of EXEC-8; a modular "Communications/Symbiont Processor"; a disk subsystem (Model 8440) for storing up to 1.2 billion characters on 8 drives; a 1000 cpm cardreader (Model 0716); an 1100-2000 lpm printer subsystem (Model 0768); and a mag tape subsystem consisting of 1 or 2 control units and from 1 to 16 Uniservo 20, 200 ips, 1600 bpi mag tape units.

SUPERMINI

Would you believe an 8K by 18-bit computer weighing only 10 lbs., smaller than a desk telephone, and sturdy enough to be "tossed from a window"? We didn't either. But Bunker-Ramo's Electronic System Div. has come up with one to illustrate their new "Planar-Coax" proprietary packaging technology. "Planar-Coax" essentially involves sandwiching special interconnecting copper wafers between wafers of high-density integrated circuits and then physically squeezing the resultant wafer stack into an almost solid assembly. The BR-1018 computer described is one of the first devices to be packaged with the new technique. Initially it will be priced at approximately $30,000 in small quantities. With mass production, however, Bunker-Ramo expects the price could drop as low as $5,000.

ADAPSO ON PRIVACY

Individual privacy and the computer is the subject of a position paper issued by the Computer Timesharing Services Section of the Assoc. of Data Processing Service Organizations (ADAPSO). The group asserts that, while privacy involves issues of fundamental human rights and liberties, there is a degree of social good to be derived from intelligently conceived data banks. It further states that such information should be controlled, but that hasty legislation could result in a lack of benefits to the individual. A list of measures contained in the position paper include updating of information, the rights of individuals to know what information is being distributed about them, and the right of companies to gather and discriminately disseminate this information. The paper is available from ADAPSO, 551 Fifth Ave., NYC 10017.

ACM COMMENTS ON SQUIRE CASE; CPP COMMENTS ON ACM COMMENTS

In response to a plea to help raise bail for imprisoned programmer Clark Squire, the Council of the Assoc. for Computing Machinery has issued a news release stating that "while individual members might respond, ACM action was outside of its constitutional purposes." The request for aid came from "Computer People for Peace" during ACM's September conference in N.Y.C. (See **MODERN DATA**, Nov. 1970, pp. 70-71.) The Council's statement went on to urge ACM members, "as individuals, to familiarize themselves with the facts in this case and to take whatever action they regard as appropriate." In conclusion, the release cited the availability (from **ACM Headquarters, 1133 Ave. of the Americas, N.Y.C. 10036**) of a 40-page, ACM-prepared document based on interviews with Squire, his attorney and former employers, CPP representatives, and various other principals and parties concerned with the Squire case.

Asked for comments on the release, Miss Ann Rosenberg, CPP's press coordinator, stated that she did not receive a copy of either the release or the prepared document. When the release was read to her over the phone, however, she said: "I cannot see how the ACM can reconcile its present argument that 'ACM action is outside of its constitutional purposes' with such earlier ACM activities as obtaining people to testify before a congressional committee in regard to the Army's files on civilians. Certainly the latter action could be no more justified by their constituion."

ORDERS AND INSTALLATIONS

The Los Alamos Scientific Laboratory has installed and accepted a second Control Data 7600 computer system, valued at $6.3 million, to process nuclear energy research and development data.

The Atchison, Topeka and Santa Fe Railway has awarded a contract for the production of nine Kar-Trak Automatic Car Identification systems. The systems will be produced by the Commercial Electronics Division of GT&E Information Systems, Inc., a subsidiary of General Telephone & Electronics Corp.

Computer Communications, Inc., Inglewood, Cal., has been awarded a $100,000 contract by Mead Data Central, Inc., Dayton, Ohio, for two CC-70 Computer Communicators. The CC-70's will be interfaced to IBM 360/40 computer systems located in Dayton, Ohio and Arlington, Va.

The Minnesota Mutual Life announced that it is developing a giant computer-based information system. It will include equipment and services valued at nearly $6 million from IBM, independent companies, and Minnesota Mutual Systems personnel. Included will be the recently announced IBM System/370 computer.

Di/An Controls, Inc. has received a $2.6 million contract from Computer Sciences Corp. to provide 1,000 ticketing terminals as part of the New York City Off-Track Betting System. The first terminals are expected to be operating in several betting parlors in NYC in January.

Wyle Computer Products, Inc., El Segundo, Cal., has received a contract, valued in excess of $2 million, from Computer Sciences Corp. for data terminals to be used in the New York City Off-Track Betting System. CSC is prime contractor for the Off-Track Betting System, which, when fully implemented, will include approximately 1150 Wyle Computerminals.

Republic Steel Research Center has completed installation of a Xerox Data Systems Sigma 5 computer for use in developing new products, and in improving steel making processes.

Ampex Corp. has delivered three Model ECM-50 extended core memory systems to Allen-Babcock Computing Inc. of Los Angeles for on-line use with IBM 360/50 computers.

The University of Paris announced that it intends to install a Univac 1110 computer system, recently introduced as the largest, most powerful, and most flexible computer yet developed by Sperry Rand Corp.'s Univac Division. Value of the Univac 1110 exceeds $2.5 million. It is scheduled for delivery in January, 1972.

On behalf of the National Clearinghouse for Mental Health Information, the National Institute of Mental Health has awarded Informatics Tisco, Inc., a subsidiary of Informatics, Inc. Canoga Park, Cal., a $217,000 contract to abstract and index documents from the world-wide mental health literature.

HAROLD V. SEMLING JR., Washington Editor

DC DATASCAN

FAST CENSUS FEEDBACK — In 1960 the Bureau of the Census provided businessmen with Census information on computer tape. The improvement and expansion of this program will be the most important 1970 development in the Census according to Dr. George Hay Brown, the Bureau's director. He emphasized that statistics by geographic unit will be available more quickly than ever before.

ELECTRONIC MAIL BOXES — C. Peter McCullough, President of Xerox Corp., spoke before National Postal Forum IV in Washington. He argued that it is time to think of "mail handling" as a systems problem, a problem that involves hardware, software, and people. For example, he noted that bills and bank statements, many of which are now computer generated, could be transmitted electronically and reduced to hard copy at receiver's facility.

RAMIS — A new computerized operation of the Department of Housing and Urban Development now keeps track of HUD projects by name, locality, age, and estimated budget cost. Called RAMIS, for Regional Administrators' Management Information System, the computer is programmed to provide data on each project at any given stage. If a project shows signs of lagging behind schedule, RAMIS dashes off a crisp warning note to the field where the delinquent project is located.

AWARD WINNERS — Two of the first fifteen winners of the Presidential Management Improvement Award received those awards for their contributions in modern data systems. The award was created to serve as the capstone for all management improvement awards and to emphasize President Nixon's Government-wide concern with better management and economy in Government. The award winners included the following:

Van A. Wente, Bethesda, Md., Chief of the Systems Development Branch, National Aeronautics and Space Administration, for the conception, planning, design, and successful implementation of the first computer system of its kind to achieve practical operation in the on-line retrieval of scientific, technical, and management information.

Vincent P. Barazzone, Vienna, Va., Project Coordinator, Department of the Navy, for discovering means to prove out all critical elements in a major Navy digital communications system before the system was deployed worldwide, saving the Navy $15.6 million in Fiscal Year 1970.

FIGHTING CRIME — The U.S. Department of Justice is granting funds to law enforcement agencies for the improvement of criminal justice programs. A number of recent awards involve computer systems. Some of these are — $150,000 to the Tulsa Police Department to develop an automated criminal identification system; $30,000 to the Michigan Department of Corrections to develop the corrections sub-system of the state's Criminal Justice Information System; $30,000 to the Georgia Department of Public Safety to expand the state's criminal statistics information program; $32,645 to the city of Albuquerque to convert the Municipal Court's manual system of record-keeping to an automated system; $61,169 to the Anchorage, Alaska Police Department to develop an automated data processing system.

URBAN TRANSPORTATION PLANNING — The Minneapolis-St. Paul, Minn. area will be used by the Department of Transportation for the demonstration of a computer program designed to improve transportation. A $71,200 contract has been awarded to the Metropolitan Council of Twin Cities for the project which involves federal and local agencies. Under a previous contract, Planning Research Corp., Los Angeles, developed the Urban Performance Model. This model measures an urban environment's performance as a social, economic, and technological system. The Minnesota experiment will test the model as a tool for planning urban transportation.

COMPUTERIZED HOSPITALS — The Department of Defense is investigating a health care system to provide a "new generation" of military hospitals for the late 1970's. DoD believes that facility operating costs might be reduced 10 percent through computers and automation.

IN BRIEF

Occupations directly related to work with computers will be among the most rapidly growing in the next 10 years, the Labor Department says.

The General Services Administration has announced a $335,596 EDP support contract to the black-owned firm of D. P. Associates, Inc.

A computerized procedure for fingerprint identification has been developed by the National Bureau of Standards.

Dr. Ruth M. Davis has been appointed Director of the Center for Computer Sciences and Technology at the National Bureau of Standards.

Post Office officials have announced plans to consolidate the U. S. Postal Service Laboratory and POD's Advanced Technology Div.

Now. A monolithic memory lets you forget stop-and-go keypunching.

IBM announces a keypunch that isn't stop-and-go. It's another reason we're the company behind the computer.

We have a keypunch that's designed to help your people become more productive.

It's called the IBM 129 Card Data Recorder.

It comes in models that both punch and verify cards.

And it lets your operators key data into a *monolithic memory* that serves as a buffer before the cards are punched.

What does this new technology mean to you?

It means that your operators can key data *continuously*. Even while another card is being punched and stacked.

It means that they can make corrections before a card is punched. Which in turn means that an entire card won't have to be repunched because of a single mistake.

It means that your operators can work at their fastest speed.

The 129's monolithic memory will store up to six different card formats so your operators can change them easily without interrupting their work flow.

Exclusive options: An "accumulate" feature will total selected card fields. Another feature provides a count of keystrokes and cards.

It has all these new advantages. Yet it has the same familiar keyboard. So your operators won't have to be retrained to use it.

We believe our job is to help you get the most out of your computer.

And that is another reason we're the company behind the computer.

IBM.®

The company behind the computer.

INTERNATIONAL NEWS

DEMAND RISING — Scandinavian demand for EDP equipment is climbing at a rate of 20 percent a year and is expected to pass the $200 million mark by 1973, the U.S. Department of Commerce's Bureau of International Commerce reports. Computer inventory, estimated at 1,300 systems is expected to double by the end of 1973.

COMPUTERS IN PORTS — W. H. Fockema Andreae, President of the Rotterdam Chamber of Commerce, has called for world-wide standardization of computer systems which serve ports. In his comments, reported in **The Journal of Commerce,** Mr. Fockema Andreae also described the effects of Shell Oil's computerization on traffic in the port of Rotterdam: "Royal Dutch Shell is our most important customer for oil . . . If a long, cold winter is predicted the [Shell] computer reacts and starts a concentrated reaction which results in heavy traffic to and from Rotterdam. It is a most sophisticated technique and works well."

BIG BEETLE TESTER — Control Data Corp. has received an order from Volkswagenwerk A.G. (of Wolfsburg, Germany) for $14 million worth of computer services to be used in the auto maker's Research and Development center. The large on-line computer system will control approximately 60 automobile test stands to test automobile elements.

Development of the system has taken over a year and it will not be fully operational until Autumn 1972. The equipment includes a CDC 6500 large-scale computer, several CDC 1700's that will operate as satellites to the 6500, and CDC 1500 series data acquisition devices.

NORWEGIAN SHIP SYSTEM — Noratom-Control, a Norwegian engineering firm, has designed an advanced marine automation system. Now in use on the freighter Taimyr, the system is being applied to four areas—engine room, bridge, cargo handling, and administrative routines. On the bridge, the system provides collision warnings, projects future traffic situations, and simulates alternate maneuvers. In the radio room, it can be used in connection with a Telex for communication. Also it is used to program loading procedures, and to control on-board cargo refrigeration plants.

EAST-WEST TRADE — U.S. businessmen continue to press for more East-West trade. One of the most promising fields for U.S. exports is computers and software. Eastern European countries are looking for modern equipment and technology. U.S. regulations, however, impose export controls on some of the products sought by Eastern European countries. German, English, French, and Japanese businessmen are interested in this trade opportunity and are not hampered by the same restrictions as American firms.

East Germany recently concluded a trade agreement with the USSR for 1971-75. A part of the agreement, covering about $28 billion in trade, is cooperation in computer development.

West German executives have also been looking at the lucrative Russian market. Siemens has been conducting negotiations with Moscow for know-how and cooperation in EDP.

A computer show held in London by the British Trade Equipment Association in October found exhibitors from W. Germany, Poland, Hungary, France, U.S., Belgium, and Israel. Delegations came from Hungary and Yugoslavia.

QUICKLY AROUND THE WORLD

Consolidated Computer, Waltham, Mass., has signed a three-year sales agreement with International Computers Ltd., London, for the delivery of over $50 million of its Key-Edit systems.

International Computers, London; Control Data, and Compagnie Internationale pour l'Informatique, Paris, have registered a joint company, International Data, in Brussels.

The Communications Satellite Corp. (COMSAT), as manager for the International Telecommunications Satellite Consortium (INTELSAT), has awarded a $33,326 contract to Plessey Telecommunications Research Ltd., Berkshire, England, to perform simulation studies by computer of a digital satellite communications chain.

Export-Import Bank of the U.S. has authorized a $500,000 credit to Banco Credito Agricola de Cartago, a private financial institution in Costa Rica. Funds are for financing the purchase of U.S. machinery and equipment, including computers.

300 Bits/Sec Full Duplex Modem on one P.C. Card

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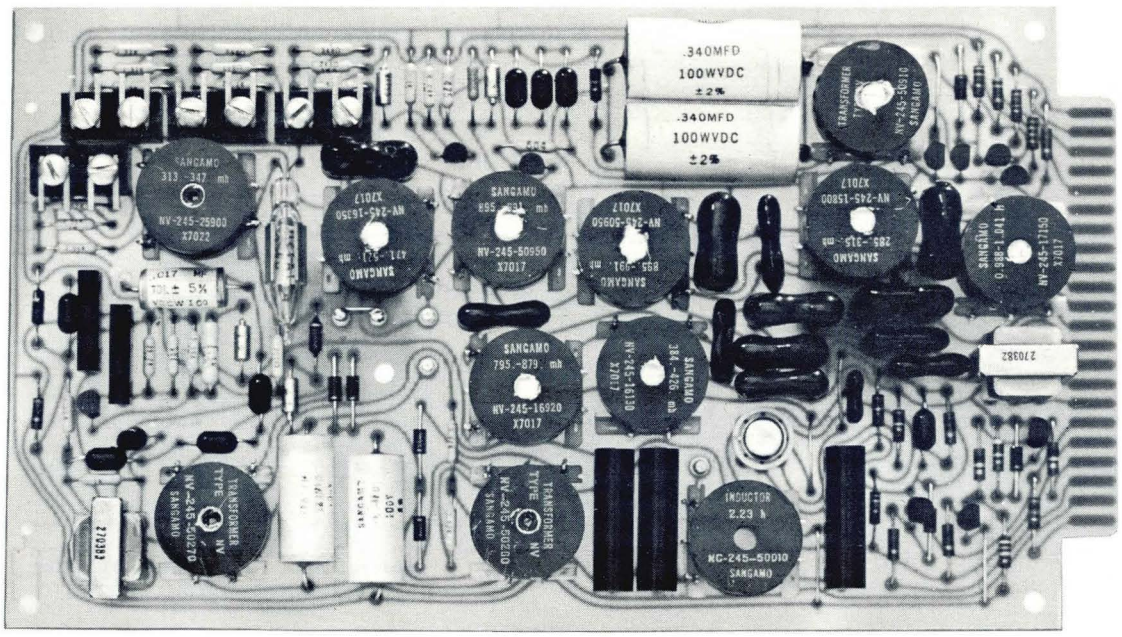

C113AS

- ☐ Frequencies compatible with Bell 103E, 103A, 103F, 101C, 113A
- ☐ Card Size 5" x 9"
- ☐ Channel separation 60 db
- ☐ Transmit level—0 to -12dbm
- ☐ Receive level—0 to -45 dbm
- ☐ Local copy—selectable
- ☐ Interface—EIA/TTL

When you make the decision to build the modem into your terminal, call Sangamo . . . the people that make modems for the telephone companies, the OEM's and the end users. Application assistance as near as your phone. Need data? Let's communicate.

Communication Systems

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T70-05

CORPORATE AND FINANCIAL NEWS

CDC JOINT VENTURES

Control Data Corp., International Computers Ltd. of Great Britain, and Compagnie Internationale Pour L'Informatique of France are forming a "joint study company," International Data, to be registered in Belgium. Initial goal of the cooperative venture will be to make recommendations concerning the compatibility of the parent companies' future products and services. • On the domestic scene, CDC and GT&E Information Systems, Inc. (a subsidiary of General Telephone & Electronics Corp.) have formed Brokerage Transaction Services, Inc. to provide automated front- and back-office services to investment brokers. Ultronics Systems Corp., the largest of the companies forming the nucleus of GT&E Information Systems, operates a 100,000-mile international stock and commodity quotation network with more than 18,000 CRTs currently in use in brokerage houses.

MERGERS AND ACQUISITIONS: **Allied Management & Systems Corp.,** N.Y.C., has acquired an 80 percent interest in **Computer Methods Corp.** of White Plains, N.Y. from Coburn Corp. of America . . . The **Bendix Corp.** has acquired **Logitron, Inc.,** a young Cambridge, Mass. company that early this year introduced its first product, a portable CRT terminal . . . **Boothe Computer Corp.** has purchased 100 percent of the stock of **GAC Computer Leasing Corp.,** a subsidiary of GAC Corp., for $5.3 million. BCC will also assume approximately $38 million of senior debt from GAC . . . **Certron Corp.,** Anaheim, Cal., has acquired substantially all of the operating assets related to the magnetic computer tape business of the **MAC Panel Co.,** a division of Adams-Millis Corp. of High Point, N. Carolina . . . **Magnecomp, Inc.** of Mountain View, Cal. has acquired the facilities of memory disk manufacturer **Jensen Munro.** Magnecomp, a subsidiary of Electro-Coatings, Inc., produces plated disks and drums for digital and analog memory systems . . . The **Magnetic Head Corp.** of Hauppage, N.Y. has agreed in principle to merge **Applied Fluidics, Inc.** of Stamford, Conn. into a newly-created subsidiary of MHC . . . **Optimum Systems Inc.** of Palo Alto, Cal. has acquired the net assets of **Delta Computer Corp. and its wholly-owned subsidiary, Automated Systems Inc.,** a Louisiana corporation providing data processing services . . . Typesetting equipment manufacturer **Photon, Inc.** intends to acquire either all of the assets or all of the outstanding capital stock of **Bridge Data Products, Inc.,** a developer and producer of computer peripherals . . . **Suburban Computer Services, Inc.** claims the title of "largest computer service bureau in Chicago's northwest suburbs" as the result of its recent purchase of **American Data Centers'** Palatine, Ill. office . . . **Tracor Computing Corp.,** Austin, Tex.-based computing services company, has expanded its petroleum consulting and

BOX SCORE OF EARNINGS

Company	Period	Revenues	Net Earnings (Loss)	Earnings (Loss) per Share
Ampex	6 mos. 10/31/70	138,960,000	1,380,000	.13
	6 mos. 10/31/69	149,269,000	7,426,000	.69
Computer Dimensions	9 mos. 9/30/70	4,089,000	165,000	.13
	9 mos. 9/30/69	3,004,000	(595,000)	(.60)
Computer Usage	12 mos. 9/30/70	5,522,900	(2,482,689)	(2.92)
	12 mos. 9/30/69	11,466,202	(1,536,586)	(1.81)
Com-Share	12 mos. 6/30/70	4,878,846	(3,491,336)	(4.36)
	12 mos. 6/30/69	3,872,103	(2,262,770)	(3.94)
Control Data	9 mos. 9/30/70	401,779,000	9,923,000	.61
	9 mos. 9/30/69	410,454,000	42,731,000	2.90
Data General	12 mos. 9/26/70	7,035,000	736,000	.38
	12 mos. 9/27/69	1,034,000	(268,000)	(.17)
Data Products	6 mos. 9/26/70	19,457,000	(987,000)	(.15)
	6 mos. 9/27/69	18,449,731	708,711	.12
Data Trends	12 mos. 6/30/70	7,254,664	505,511	.54
	12 mos. 6/30/69	944,366	(2,031,795)	(2.42)
Dig. Inf. Devices	3 mos. 9/30/70	306,000	(232,000)	(.10)
	3 mos. 9/30/69	91,000	(373,000)	(.16)
Elec. Mem. & Mag.	9 mos. 9/26/70	71,366,000	772,000	-------
	9 mos. 9/26/69	67,411,000	4,155,000	.67
Fabri-Tek	6 mos. 10/2/70	10,071,688	(688,109)	(.21)
	6 mos. 9/26/69	9,271,021	255,294	.08
Infotronics	6 mos. 9/30/70	3,390,504	(98,880)	(—)
	6 mos. 9/30/69	3,218,793	46,964	-------
Int. Tel. & Tel.	9 mos. 9/30/70	4,375,198,000	238,540,000	2.17
	9 mos. 9/30/69	3,887,981,000	182,945,000	1.69
Itel	9 mos. 9/30/70	46,887,000	2,806,000	.66
	9 mos. 9/30/69	28,526,000	2,370,000	.62
Memorex	9 mos. 9/30/70	79,133,000	6,126,000	1.64
	9 mos. 9/30/69	54,834,000	4,824,000	1.31
Milgo	12 mos. 9/30/70	13,935,000	2,187,000	1.39
	12 mos. 9/30/69	8,267,000	787,000	.53
Programming Methods	3 mos. 9/30/70	4,310,232	404,599	.48
	9 mos. 9/30/69	3,176,946	284,801	.34
Redcor	3 mos. 9/27/70	2,451,000	53,000	-------
	3 mos. 9/28/69	1,303,000	(122,000)	(—)
Tally	9 mos. 10/4/70	10,853,000	264,000	.15
	9 mos. 10/4/69	7,266,000	(1,743,000)	(—)
TRW	9 mos. 9/30/70	1,217,281,000	59,966,000	1.82
	9 mos. 9/30/69	1,168,772,000	57,258,000	1.71
University Computing	9 mos. 9/30/70	97,536,000	1,316,000	.19
	9 mos. 9/30/69	73,363,000	12,045,000	1.80
Vermont Research	12 mos. 9/30/70	7,629,287	245,451	.35
	12 mos. 9/30/69	4,183,792	221,650	.34
Xerox	9 mos. 9/30/70	1,266,662,000	141,538,000	1.81
	9 mos. 9/30/69	1,092,139,000	120,489,000	1.56

computer modeling activities with the acquisition of **D & S Petroleum Consultants, Ltd.**, and **Applications Development and Engineering Group (ADE) Ltd.**, both of Canada . . . **URS Systems Corp.**, of San Mateo, Cal. entered into an agreement to acquire **Computer Programming, Inc.** of Greenville, S.C. URS's Proprietary Products Div. is presently selling CPI's packages in the Western states under an earlier agreement with Systems & Programming Services, a subsidiary of CPI.

RECENT ENTRIES IN THE COMPUTER FIELD: **The Aerojet Electrosystems Co.** has been formed in Azusa, Cal. by Aerojet-General Corp. to provide electronic sensor and data systems for advanced military/space requirements . . . **Ampex Credit Corp.**, a wholly-owned subsidiary of Ampex Corp., has been formed primarily to finance long-term accounts receivable of the Ampex video products division and full payout leases for the Videofile information systems division . . . Operations Research and Computer Corp., N.Y.C., has formed **Automated Transaction Corp.**, as a subsidiary to specialize in EDP Services for retail stores . . . Data 100 Corp. has formed a Canadian company, **Data 100 Ltd.**, to sell and service its line of data communication terminals. The new firm is located at Toronto Dominion Centre, Toronto, Ont. . . . **Medical Computer Services Inc.** has been recently formed with offices in King of Prussia and Philadelphia, Pa. The company uses an IBM 360/40 to provide on-line or batch data processing services to doctors, hospitals, and nursing homes . . . **Newton Associates**, in W. Newton, Mass., will provide technical and management consulting services to users and manufacturers of data communications equipment.

COMPUTER STOCK TRENDS

MONTH ENDED DECEMBER 11, 1970

	EXCH	COMPANY	PRICE					VOLUME (IN 100'S)			EARNINGS	
			1970 RANGE (1)	1 YEAR AGO	CLOSE DEC. 11, 1970	MONTH NET CHG.	MONTH % CHG.	THIS MONTH (3)	LAST MONTH	AVG VOLUME (2)	PER SHARE LATEST 12 MONTHS	PRICE–EARNINGS RATIO
	N	BECKMAN	19- 52	47 1/4	26	+2 7/8	+12.4	1163	1365	1689	1.43	18
	N	BURROUGHS	80-173	158 1/8	110 7/8	+5 1/4	+4.9	9718	8956	9245	3.63	31
	N	CONTROL DATA	30-123	116 1/8	50 1/2	+8 1/2	+20.2	6255	7762	8417	1.28	39
	O	DATA GENERAL	16- 36	N/A	27 3/4	+1 1/4	+4.7	(3)	-	-	0.28	99
	O	DATACRAFT	5- 19	N/A	4 3/4	-1 1/2	-24.0	(3)	-	-	-	-
	A	DIGITAL EQUIPMENT	50-124	93 5/8	63 1/8	+8 1/4	+15.0	2894	8899	5800	1.49	42
	N	ELECTRONIC ASSOC	4- 12	11 3/4	4 1/8	- 1/4	-5.7	836	611	819	-2.63	-
	O	GENERAL AUTOMATION	9- 42	N/A	14	+2	+16.6	(3)	-	-	-1.03	-
	N	GENERAL ELECTRIC	60- 91	79 5/8	91	+6	+7.0	7999	8279	8131	1.99	46
	N	HEWLETT-PACKARD	19- 46	50 5/8	30 1/4	+5	+19.8	6432	3712	3980	0.89	34
	N	HONEYWELL	66-152	146 1/2	83 7/8	+13 1/8	+18.5	6890	6848	5036	4.07	21
	O	INTERDATA	3- 13	N/A	7 1/4	+ 1/2	+7.4	(3)	-	-	-	-
	N	IBM	223-387	355 1/2	317	+23 7/8	+8.1	7481	7283	9364	8.68	37
COMPUTERS	N	LITTON INDUSTRIES	15- 38	37 3/4	20 1/8	+ 5/8	+3.2	9551	9243	11824	1.65	12
	N	NCR	30- 63	73 1/2	36 1/4	+2 5/8	+7.8	7898	9542	8104	2.08	17
	N	RCA	18- 35	35 3/4	26 5/8	+3 1/8	+13.2	9577	7275	8365	1.48	18
	N	RAYTHEON	16- 34	33 1/2	24 1/2	+3 7/8	+18.7	2738	1972	3107	2.35	10
	O	REDCOR	4- 34	31 3/4	5 1/4	- 1/8	-2.3	(3)	-	-	-2.81	-
	O	SCIENTIFIC CONTROL	1- 9	5	1 3/4	+ 1/4	+16.6	(3)	-	-	-2.44	-
	N	SPERRY RAND	19- 40	41 3/8	24 7/8	+2 3/4	+12.4	7450	11045	10110	2.36	11
	A	SYSTEMS ENGRG LABS	11- 49	51 1/4	16	+ 1/2	+3.2	4138	7555	5611	0.78	21
	N	SYSTRON DONNER	8- 29	25 7/8	9 3/4	+ 3/4	+8.3	508	2572	693	0.71	14
	N	VARIAN ASSOCIATES	10- 29	27	12 3/4	+1	+8.5	1906	2142	4032	0.68	19
	O	VIATRON	2- 51	N/A	2 1/8	-1 1/4	-37.0	(3)	-	-	-3.38	-
	A	WANG LABS	19- 52	57	32 1/2	+1 7/8	+6.1	909	1360	1909	0.81	40
	A	WYLE LABS	3- 10	8 1/8	3 1/2	- 3/4	-17.6	517	470	822	-0.04	-
	N	XEROX	66-116	107 3/8	86 1/2	+3 1/2	+4.2	11251	12983	15591	2.33	37
	O	ADVANCED MEMORY SYS	10- 38	N/A	22 1/2	+2	+9.7	(3)	-	-	-	-
	N	AMP	41- 59	57 3/8	54 1/4	+1 7/8	+3.5	1311	1274	2358	2.01	27
	N	AMPEX	13- 49	44	17 1/2	+1 1/2	+9.3	4388	5153	5552	0.78	22
	O	APPLIED MAGNETICS	9- 26	18 3/4	16	+1 1/4	+8.4	(3)	-	-	0.54	30
	O	ASTRODATA	1- 35	N/A	3/8	-1 3/4	-82.3	(3)	-	-	-	-
	O	ASTROSYSTEMS	2- 9	7	5 7/8	+1 1/8	+23.6	(3)	-	-	-	-
	N	BUNKER RAMO	6- 15	13 7/8	10 1/8	+1 1/2	+17.3	3164	2473	3872	0.49	21
	A	CALCOMP	11- 36	26 3/8	34 7/8	+5 3/4	+19.7	6211	10993	4724	0.49	71
	O	CHALCO INDUSTRIES	2- 5	N/A	1 5/8	- 1/8	-7.1	(3)	-	-	-	-
	O	CODEX	3- 35	N/A	5 3/4	- 3/8	-6.1	(3)	-	-	-	-
	O	COGAR	37- 94	N/A	51	-1	-1.9	(3)	-	-	-	-
	O	COGNITRONICS	3- 14	13 1/2	6 7/8	+1 1/4	+22.2	(3)	-	-	-0.30	-
	N	COLLINS RADIO	10- 37	37 1/8	14 3/4	+1 3/4	+13.4	1355	1268	1970	-0.37	-
	O	COMCET	5- 50	N/A	4 7/8	- 3/8	-7.1	(3)	-	-	-	-
	O	COMPUTER COMM	5- 36	N/A	7 1/4	+1 1/4	+20.8	(3)	-	-	-0.41	-
	O	COMPUTER CONSOLES	6- 22	16	7 3/8	+ 7/8	+13.4	(3)	-	-	-	-
	A	COMPUTEST	12- 28	27 1/2	13 1/8	+1 1/8	+9.3	567	688	523	0.95	14
	N	CONRAC	11- 32	28 1/2	14 3/4	+2 1/4	+18.0	538	323	438	1.00	15
	O	DATA 100	5- 17	N/A	7 1/4	+ 1/4	+3.5	(3)	-	-	-	-
	A	DATA PRODUCTS	5- 26	22 3/4	6 1/4	- 1/4	-3.8	(3)	-	-	0.25	25
	O	DATARAM	3- 16	N/A	2 1/2	- 3/4	-23.0	(3)	-	-	-	-
	O	DATA RECOGNITION	3- 10	N/A	4 1/2	-2 1/4	-33.3	(3)	-	-	-	-
PERIPHERALS	O	DATASCAN	4- 27	22	4 1/2	- 1/2	-10.0	(3)	-	-	1.26	4
&	O	DIGITRONICS	3- 14	14 3/4	3 3/8	- 5/8	-15.6	(3)	-	-	-0.18	-
	A	ELEC ENG OF CAL	4- 15	14 1/4	4 1/8	- 3/8	-8.3	88	78	168	-0.20	-
COMPONENTS	N	ELEC MEMORIES + MAG	7- 40	29 1/4	8 1/4	- 1/2	-5.7	5293	9726	6491	0.20	41
	N	EXCELLO	17- 28	22 5/8	20	+1 3/8	+7.3	1628	804	969	2.22	9
	O	FABRI-TEK	2- 8	5 7/8	2 3/4	+ 1/2	+22.2	(3)	-	-	-0.09	-
	O	FARRINGTON MFG	2- 17	14 1/2	1 7/8	- 5/8	-25.0	(3)	-	-	-1.46	-
	A	GERBER SCIENTIFIC	9- 39	22 1/2	12 1/4	+ 3/4	+6.5	179	505	380	0.65	19
	O	GRAPHIC SCIENCES	8- 42	39	14 7/8	-1 7/8	-11.1	(3)	-	-	-1.56	-
	A	HI-G	5- 17	12 1/4	5 3/8	- 1/8	-2.2	(3)	-	-	-0.07	-
	O	INFORMATION DISPLAYS	4- 20	14 1/2	6 1/2	0	0.0	(3)	-	-	-	-
	A	ITEL	6- 26	N/A	16	- 5/8	-3.7	(3)	-	-	0.90	18
	O	LOGIC	4- 14	12 1/4	4	- 1/2	-11.1	(3)	-	-	-	-
	A	MILGO	15- 41	33 5/8	28	+ 1/2	+1.8	5749	9619	11366	1.11	25
	N	MOHAWK DATA SCIENCES	19- 87	69 3/4	26 1/2	+3	+12.7	4668	10084	6370	1.43	19
	O	NORTH ATLANTIC IND	2- 8	6 1/4	2 1/4	- 1/4	-10.0	(3)	-	-	0.70	3
	O	OPTICAL SCANNING	11- 52	53	13 1/2	-3	-18.1	(3)	-	-	-0.54	-
	A	POTTER INSTRUMENTS	15- 43	35 5/8	18 5/8	+ 5/8	+3.4	891	2265	3053	0.90	21
	O	RECOGNITION EQUIP	12- 84	70	14 1/8	+ 1/8	+0.8	(3)	-	-	0.38	37
	N	SANDERS ASSOCIATES	7- 30	24 7/8	11 3/4	+ 5/8	+5.6	1272	1355	1511	0.19	62
	N	SANGAMO	9- 29	24 1/2	14 1/2	+ 3/4	+5.4	844	1624	1169	0.46	32
	O	SCAN-DATA	5- 53	33	6 1/4	+ 3/4	+13.6	(3)	-	-	-	-
	A	SEALECTRO	4- 13	7 3/8	4 1/8	- 3/8	-8.3	144	140	227	0.07	59
	O	SYKES DATATRONICS	2- 9	N/A	2 7/8	+ 1/2	+21.0	(3)	-	-	-	-
	O	TALLY	10- 23	17	12	- 1/2	-4.0	(3)	-	-	0.21	57
	N	TELEX	10- 26	21 7/8	20 3/8	+ 3/4	+3.8	20972	55255	31100	0.99	21
	N	TEXAS INSTRUMENTS	62-135	119 3/4	80 3/4	+9 1/4	+12.9	3703	3345	3975	3.08	26
	O	VARIFAB	1- 5	5 1/2	1 3/4	- 1/2	-22.2	(3)	-	-	-	-

FOOTNOTES: (1) TO NEAREST DOLLAR
(2) AVERAGE MONTHLY TRADING VOLUME SINCE JANUARY 1, 1970
(3) VOLUME IS NOT REPORTED FOR OVER-THE-COUNTER ISSUES AND NEW LISTINGS

EXCH: N=NEW YORK EXCHANGE; A=AMERICAN EXCHANGE; O=OVER-THE-COUNTER; L=NATIONAL EXCHANGE;

All statistics compiled, computed and formatted by TRADE*QUOTES Inc., Cambridge, Mass. 02139

TRADE*QUOTES

	EXCH	COMPANY	PRICE					VOLUME (IN 100'S)			EARNINGS	
			1970 RANGE (1)	1 YEAR AGO	CLOSE DEC. 11, 1970	MONTH NET CHG.	MONTH % CHG.	THIS MONTH (3)	LAST MONTH	AVG. VOLUME (2)	PER SHARE LATEST 12 MONTHS	PRICE–EARNINGS RATIO
SOFTWARE & SERVICES	A	APPLIED DATA RESCH	4- 24	23 3/8	4 5/8	-1 3/8	-22.9	350	268	813	-0.31	-
	O	APPLIED LOGIC	1- 19	N/A	1	- 3/8	-27.2	(3)	-	-	-	-
	O	ARIES	1- 8	6 1/4	1 5/8	- 5/8	-27.7	(3)	-	-	-	-
	N	AUTOMATIC DATA PROC	22- 48	35 3/4	47 1/4	+5 5/8	+13.5	2052	1940	3560	0.70	68
	A	BOLT, BERANEK, NEWMA	6- 11	13 1/4	6	- 5/8	-9.4	(3)	-	-	0.26	23
	O	BOOTHER COMPUTER	8- 26	25 1/2	12 3/4	+ 1/2	+4.0	(3)	-	-	1.57	8
	O	BRANDON APPLIED SYS	1- 10	9 1/4	1 1/8	- 1/4	-18.1	(3)	-	-	-	-
	O	COMP ENVIRONMENTS	1- 14	N/A	1 1/4	- 1/2	-28.5	(3)	-	-	-	-
	O	COMPUTER EXCHANGE	3- 8	7 1/2	4	-1	-20.0	(3)	-	-	-	-
	A	COMPUTER INVESTORS	4- 12	9 3/4	7 1/8	0	0.0	165	154	273	0.57	13
	O	COMPUTER METHODS	1- 3	N/A	5/8	0	0.0	(3)	-	-	-	-
	O	COMPUTER PROPERTY	5- 15	N/A	5	0	0.0	(3)	-	-	-	-
	N	COMPUTER SCIENCES	6- 34	30 1/2	10 1/8	- 1/8	-1.2	4175	7273	10252	0.16	63
	O	COMPUTER TECHNOLOGY	2- 13	N/A	4 5/8	- 3/4	-13.9	(3)	-	-	-	-
	O	CTC COMPUTER	1- 19	N/A	2 1/8	- 3/8	-15.0	(3)	-	-	-	-
	O	COMPUTER USAGE	2- 9	11 1/2	5	+1 1/8	+29.0	(3)	-	-	-2.05	-
	A	COMPUTING + SOFTWARE	18- 76	61 1/2	31 1/8	+3 1/8	+11.1	1167	2044	1977	1.32	24
	O	COM-SHARE	3- 15	N/A	4 1/4	+ 3/8	+9.6	(3)	-	-	-	-
	O	CYBERMATICS	5- 14	9 1/4	9	+1 1/8	+14.2	(3)	-	-	-	-
	O	DATA AUTOMATION	1- 24	N/A	1 1/4	- 5/8	-33.3	(3)	-	-	-	-
	O	DATA DYNAMICS	1- 4	N/A	3/4	- 3/8	-33.3	(3)	-	-	-	-
	N	DATA PROC FIN + GEN	7- 32	30 3/4	11 1/4	- 1/8	-1.0	4116	3328	3509	0.36	31
	O	DATA SYSTEMS ANALYST	1- 6	N/A	2 1/4	0	0.0	(3)	-	-	-	-
	O	DATRONIC RENTAL	2- 8	6	2 1/2	- 1/2	-16.6	(3)	-	-	-	-
	A	DEARBORN COMPUTER	10- 24	24 3/4	20	- 1/8	-0.6	349	410	578	1.47	14
	O	DECISION SYSTEMS	1- 4	3 1/4	1	- 1/4	-20.	(3)	-	-	-	-
	O	DIGITAL APPLICATIONS	2- 7	4	2 3/8	+ 5/8	+35.7	(3)	-	-	-	-
	O	DIGITEK	1- 5	N/A	1 1/4	- 1/8	-9.0	(3)	-	-	-	-
	A	DPA, INC	3- 10	9 5/8	4	- 1/4	-5.8	556	436	660	0.69	6
	O	EFFICIENT LEASING	1- 5	3 1/4	1 1/4	- 1/4	-16.6	(3)	-	-	-	-
	A	ELEC COMP PROG INST	3- 12	9 7/8	3 1/2	- 1/2	-12.5	217	222	362	0.01	350
	O	ELEC DATA SYSTEMS	31-161	144	58 1/2	+2 1/2	+4.4	(3)	-	-	0.67	87
	A	GREYHOUND COMPUTER	5- 14	13	6 3/8	- 1/4	-3.7	243	289	333	0.76	8
	O	INFORMATICS	4- 21	N/A	6	0	0.0	(3)	-	-	0.04	150
	O	INTL COMPUTER	1- 8	7	2	-1	-33.3	(3)	-	-	-	-
	L	INTL COMPUTER SCI	1- 3	N/A	7/8	- 1/4	-22.2	(3)	-	-	-	-
	N	LEASCO	7- 31	24 1/8	14 1/4	+3 3/4	+35.7	9991	6040	7692	1.86	8
	O	LEVIN-TOWNSEND	3- 19	18	5	- 1/2	-9.0	(3)	-	-	-1.20	-
	O	LMC DATA	1- 4	2 1/2	5/8	- 1/2	-44.4	(3)	-	-	-0.52	-
	O	MGMT ASSISTANCE	1- 4	N/A	5/8	- 1/2	-44.4	(3)	-	-	-	-
	A	MANAGEMENT DATA	8- 26	20 7/8	7 3/4	-1 5/8	-17.3	111	220	225	0.73	11
	O	NATIONAL COMP ANAL	1- 9	4 3/4	2 3/8	+ 1/8	+5.5	(3)	-	-	-	-
	N	PLANNING RESEARCH	14- 53	44 3/4	18 1/4	+ 1/2	+2.8	2302	3090	2914	0.72	25
	O	PROGRAMMING METHODS	9- 27	20 1/2	15 1/2	0	0.0	(3)	-	-	-	-
	L	PROGRAMMING SCIENCES	1- 17	N/A	3/4	-1	-57.1	(3)	-	-	-	-
	O	PROGRAMMING SYSTEMS	2- 6	3 3/4	2	0	0.0	(3)	-	-	0.14	14
	O	SCIENTIFIC COMPUTER	1- 4	3	1 3/4	- 3/8	-17.6	(3)	-	-	0.09	19
	N	SCIENTIFIC RESOURCES	2- 15	12 1/2	3 1/2	- 1/8	-3.4	2178	2551	3793	-0.98	-
	O	SYSTEMS CAPITOL	1- 8	4 1/2	2 1/4	- 1/4	-10.0	(3)	-	-	-	-
	O	TIME SHARE	1- 7	N/A	5/8	- 5/8	-50.0	(3)	-	-	-	-
	O	TRACOR COMPUTING	2- 8	N/A	2 1/8	+ 3/8	+21.4	(3)	-	-	-0.89	-
	A	URS SYSTEMS	5- 21	N/A	6 3/4	- 1/2	-6.8	(3)	-	-	0.41	16
	O	UNITED DATA CENTERS	1- 5	3 3/4	2	0	0.0	(3)	-	-	-	-
	N	UNIVERSITY COMPUTING	14- 99	101 3/4	21 1/2	+1 1/2	+7.5	6662	20802	14137	0.97	22
	O	US TIME SHARING	2- 14	N/A	2	- 1/8	-5.8	(3)	-	-	-	-
SUPPLIES & ACCESSORIES	N	ADAMS MILLIS	8- 15	13 1/2	11 5/8	- 7/8	-7.0	438	366	437	1.19	10
	O	BALTIMORE BUS FORMS	7- 21	N/A	7 1/4	+ 1/4	+3.5	(3)	-	-	-	-
	A	BARRY WRIGHT	6- 25	21 3/8	9 1/4	+1 5/8	+21.3	509	335	579	0.62	15
	A	CAPITOL INDUSTRIES	12- 54	49 7/8	16 1/4	+1 5/8	+11.1	1328	1653	1549	1.44	11
	A	DATA DOCUMENTS	15- 36	33 1/2	17 5/8	+ 3/8	+2.1	92	62	114	1.68	10
	O	DATA PACKAGING	5- 29	26 3/4	5 3/4	- 1/4	-4.1	(3)	-	-	0.51	11
	N	DENNISON MFG	11- 25	20 3/4	20 7/8	+2 7/8	+15.9	832	1953	1279	1.54	14
	N	DUPONT	93-129	105 1/2	129	+10 1/4	+8.6	3551	3729	3873	7.02	18
	N	ENNIS BUSINESS FORMS	9- 19	18 1/2	10 1/2	+ 1/4	+2.4	493	378	318	0.92	11
	O	GENERAL BINDING	14- 31	32	25	+ 1/2	+2.0	(3)	-	-	0.84	30
	O	GRAPHIC CONTROLS	7- 17	17 1/2	6 5/8	- 3/4	-10.1	(3)	-	-	0.27	25
	O	LEWIS BUSINESS FORMS	11- 20	17 1/4	10 1/2	-2	-16.0	(3)	-	-	0.91	12
	N	MEMOREX	46-167	161 3/4	80 1/2	+6 7/8	+9.3	9010	11600	12538	2.20	37
	N	3M	72-115	111 3/8	97	+10 3/4	+12.4	5401	11636	5599	3.31	29
	O	MOORE CORP LTD	27- 38	N/A	36	+4	+12.5	(3)	-	-	-	-
	O	REYNOLDS + REYNOLDS	25- 49	43	37 1/2	- 1/2	-1.3	(3)	-	-	1.49	25
	A	SAFEGUARD INDUSTRIES	7- 16	13 7/8	9 3/4	+ 7/8	+9.8	746	522	524	0.81	12
	O	STANDARD REGISTER	17- 31	26 3/4	18	0	0.0	(3)	-	-	1.98	9
	N	UARCO	22- 39	34	25 3/4	+2 3/4	+11.9	109	164	187	2.16	12
	O	WALLACE BUS FORMS	9- 21	18 7/8	18	+ 5/8	+3.5	(3)	-	-	1.17	15
AVERAGES		COMPUTER STOCKS	12–36	36.69	18.36	+1.03	+5.6				0.78	23.5
		DOW JONES INDUSTRIALS	631–826	793.03	+825.92	+65.9	+8.0				3.19	15.8

CORPORATE PROFILE

Featured this Month:

ITEL CORPORATION (American & Pacific Coast Stock Exchanges)
San Francisco, Cal. 94104

OFFICERS & DIRECTORS: **Fred H. Merrill,** Chairman of the Board, Chairman of the Executive Committee, American Express Co.; **Peter S. Redfield,** President; **Gary B. Friedman,** Executive Vice Pres. and Director; **Brooke P. Taylor,** Director and President, ITEL International; **Greer M. Arthur, Jr.,** President, SSI Container Corp.; **William H. Bird,** President, ITEL Processing Div.; **Douglas W. Johnson,** Controller; **R. Douglas Norby,** Vice Pres., Finance; **John H. Pickart,** President, ITEL Information Products Div.; **Donald S. Safford,** Secretary of the Corporation; **Donovan S. Thayer,** Vice Pres., President of the ITEL Equipment Leasing Div.; **John S. Anderson, Jr.,** President, Rexport Corp.; **Daniel D. Jackson,** Senior Vice Pres., F. I. DuPont Glore Forgan; **Franklin B. Lincoln, Jr.,** Mudge Rose Guthrie & Alexander; **William B. McWhirter,** formerly President, Data Systems Div., IBM; **Harry A. Olson, Jr.,** Vice Pres. Corporate Development, American Express Co.; **Henry A. Walker, Jr.,** President, AMFAC, Inc.

BACKGROUND: ITEL was organized in December, 1967, under the name SSI Computer Corp. In June, 1969, ITEL assumed its present name.

FACILITIES: Corporate headquarters are located in San Francisco. Some of ITEL's other locations are in Palo Alto, Cal., Greeley, Colo., Harrison, N. Y., and Monaco.

SERVICES/PRODUCTS: In July 1970, ITEL introduced a new, low-cost revision typewriter — the ITEL Word Processor, which offers a high-speed method of making corrections on original rough drafts and operates on paper tape playback. It is inexpensive, easy to operate, can be used on any ordinary desk top, and finishes letters at the rate of 175 words per minute.

The Data Processing Division principally markets computerized accounting services. ITEL believes that it is the largest processor of accounts receivable in the world.

Also, ITEL is one of the nation's largest lessors of IBM System/360 equipment. The total inventory is over $200 million. Presently, there are 130 customers on 210 leases. In addition, ITEL offers leases in areas such as airline, railroad, and maritime equipment. In July 1969, ITEL entered the computer peripheral equipment field by acquiring 65 percent of Diablo Systems. Diablo has developed both a computer disk drive and an output printer. Meaningful sales will begin in the current quarter.

OUTLOOK: ITEL seeks to become a total data processing company with an end-user marketing and service organization. By employing its substantial computer leasing profits and through utilization of its borrowing power (over $40 million raised in this tight money market) ITEL has vigorously and profitably expanded its operations through acquisition in growth markets.

CURRENT POSITION: While committed to external growth, ITEL has also emphasized internal development. The results are now being realized. Consolidated revenues for the 1970 third quarter amounted to $17,379,000 against $11,111,000 during the same period in 1969.

FINANCIAL SUMMARY: For the first nine months of the year total earnings were reported as $2,806,000 or $0.66 per share as compared to $2,370,000 in earnings and $0.62 per share for the comparable period last year.

YEAR ENDED DECEMBER 31

Year	Revenues (Millions)	Net Income (Millions)	Earnings Per Share
1968	9.8	0.5	$0.17
1969	40.4	3.3	0.86
Nine Months (ended 10/30/69)	28.5	2.4	0.62
Nine Months (ended 10/30/70)	46.9	2.8	0.66

just the ticket

This Bunker-Ramo data terminal system gives instant access to traffic ticket records of 1,800,000 drivers.

Bunker-Ramo, with more on-line/real-time experience than anyone else, provides the data entry and retrieval system for the Motor Vehicle Department of one of the most populous states.

The present headquarter's system is being expanded, with a new CDC computer, and will be remoted to seven regional offices with Bunker-Ramo Series 2200 CRT (Cathode Ray Tube) terminals. Some are located right on the judges' benches in municipal courts, for use after trial and before sentencing to determine the violator's past driving record.

What started as a headquarters convenience is expanding to a statewide law-enforcement tool.

For real-time access, go with the leader. Our experience with municipalities, airlines, manufacturers and businesses of all kinds will prevent runaway costs on your real-time project.

If this is just the ticket for you, contact Mr. Guy Mallery, Vice President, Business & Industry Division, The Bunker-Ramo Corporation, 445 Fairfield Avenue, Stamford, Connecticut 06904. Phone (203) 348-4291.

The real real-time people.

THE BUNKER-RAMO CORPORATION

® Business & Industry Division

A REVIEW & FORECAST

Communications Clinic is a regular monthly column written by the staff of **Berglund Associates, Inc.**, consultants in telecommunications. Readers are invited to submit questions on any aspect of communications or suggestions for future Clinics to:

Communications Clinic
c/o Berglund Associates, Inc.
1060 Kings Highway North
Cherry Hill, New Jersey 08034

WHERE IS THE INDUSTRY TODAY?

We rate the computer-communications field as A+ for excitement and potential, but B— for progress. We are particularly disappointed in the state of the terminal and modem marketplace, in which we find little to excite us. There have been few significant breakthroughs (i.e., a doubling, tripling, etc. in performance) since the 9600 bps modems first demonstrated commercially in 1967. We have seen improvements in cost-performance, but these are a direct result of manufacturing cost reductions attributable to medium- and large-scale integration. The market today is characterized by a host of "me-too" products. This makes the question of vendor selection exceedingly difficult and one frequently resolved with the well-known dartboard problem resolution technique. This is not healthy because half of the vendors may not be in business to service their products two years from now. Furthermore, a multiplicity of small suppliers may preclude any one of them from the investments required for product development and improvement.

Notwithstanding ten years of communications in data processing, the Teletype low-speed terminals, in our opinion, are probably still the best price-performance equipment in the market. Admittedly, they are a tough act to follow because of their half-century (plus or minus) of development and manufacturing experience, and because of their large-scale production for the Bell System. However, if the terminal forecasts are valid, where is the Teletype competition?

The marketplace is a rash of contradictions. On the one hand we hear the cry "Crisis in Communications." On the other hand we see 139,000 Bell data sets on the DDD network at the end of 1969. On the one hand we hear Datran speak of the need for 14.4 kilobit service. On the other hand we see Dataphone 50, the switched 50 kilobit toll service, going begging. And we see the forecasts for installed narrowband data sets greatly exceeding those for higher speeds. And we see annual shipments of paper supplies to the computer industry at roughly twice those for communication terminals. We reject the crisis in communications as unjustified marketing hyperbole. We do have operational problems, and we do have cost problems. As to operational problems, fully half of the Bell System plant has been installed since 1965, and this rate will probably continue. As to cost problems, as the economy continues to grow, more will be able to cost-justify data communications; and this will be reinforced by manufacturing cost reductions in terminals and sub-systems.

With all this negativism, why an A+ for outlook? Because there is a revolution under way. We have seen more in revolutionary thinking in the past three years than in the entire 36 years of the FCC's history. Witness:

- ***the Carterfone decisions;***
- ***the approval of the MCI entry;***
- ***the proposed policy on new entries to the common carrier market.***

WHERE IS THE INDUSTRY GOING?

Simply stated, on-line. There is a growing base of users who are shaken down in batch processing. These will now turn to remote access on both a batch and conversational basis. The price-performance of terminals, communication sub-systems, and mainframes is improving through medium- and large-scale integration and through solid state memories. This trend will make it easier to cost-justify data communications. These trends also mean more intelligence per dollar in remote terminals, and less reliance on central processors and files. This will help cost-justification since its thrust is to the part of the system where costs are not decreasing, nor likely to decrease in the first half of the 70s — the communications line.

We continue to face years of non-communication about communications, i.e., the baudy brawls before the FCC and other regulatory au-

thorities. As a case in point, the Carterfone decisions were handed down 2½ years ago and we're still arguing about interconnection. The whole question of bulk bandwidth rates and policies is, alone, a complex and important issue. The directive to allow unrestricted Telpak sharing, and Telpak as we know it today, are mutually exclusive. What, then, will be the bulk bandwidth offerings, and what will be the undoubtedly higher costs for such services?

Another area of conflict is that of interconnection, which we discussed in last month's Clinic. Typical of the problems that could be encountered is the following. A privately-owned telephone incorporating a Touch-Tone type of keyboard can legally access the switched network through a $0.50 per month manual voice connect arrangement. However, if the same button-oscillator array is integral to, say, a credit card terminal, a $2 per month manual data access arrangement is presumably required. This is ridiculous and inconsistent with the need for millions of point-of-sale terminals.

We also face problems in rates from a national point of view. Imagine the chaos if the prices of unbundled services were set on a state-by-state basis. Yet that is the pricing situation in communications.

For another problem area, the proposed regulatory policies on integrated computer-communications systems are going to yield a good deal of revenue for FCC-qualified law firms. Grossly put, the policy is that a system may be subject to regulation if its primary thrust is communications. Differentiation will be difficult. We thus have a proposed policy which is structured to motivate deception. Our own view is that the natural monopoly rather stops at supplying bandwidths; and that computer switching of traffic on **common carrier facilities** should be unregulated. The exchange and private line networks allow a user an infinite opportunity to connect with a switching supplier, which should ensure as much self-regulation as in any other branch of the economy. Notwithstanding this, if abuses still occur in the market, such as restraint of trade or unfair competition, there is a whole body of statutory law with which to act.

Finally, the 70s are going to see an end to the historic common carrier monopoly on supplying bandwidth to the general public. This is a very complex and emotional issue.

In general, we favor the entry of **special-purpose carriers** on a carefully controlled basis. We can certainly see a basis for arguing that like-competition may be counter-productive for the economy. We cannot, however, become visibly moved over cries that competition in a service area representing about one percent of Bell System revenues will lead to disastrous results.

SUMMARIZING — THE '60s AND '70s

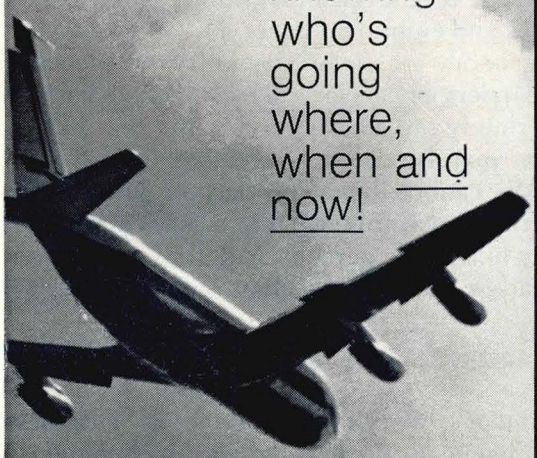
In summary, we view the 1960s as a decade of development in technique and technology. We saw the commercial introduction of modems, making data transmission a reality; we saw the development of computerized message switching; we saw the increase in voice-channel speed to 4800 bps, then 9600 bps. In applications, we have gone from off-line card-to-card transmission to fully integrated on-line systems handling industry activities from order entry through billing, and real-time information systems in banking, reservations, and security trading.

In the late 60s, usage and technology had reached a point where some of the historical communications constraints had to be broken, and such cracks appeared as authorized multiplexing and the Carterfone decisions. The 70s will be a decade of finishing that aspect of development in the art, and of a dramatic increase in use and users of data communications. We will see the common carriers increasingly cast as a vendor of bandwidth and of more versatile organizations of bandwidth. And these offerings will be in a competitive marketplace.

We entered the 70s with a solid awareness of data communications' potential and the means to implement systems. We can plan on doing so with equipment of continued price-performance improvement and in a competitive market for communications services. It should be an exciting decade for the industry. ▲

data bits from Teletype

knowing who's going where, when and now!

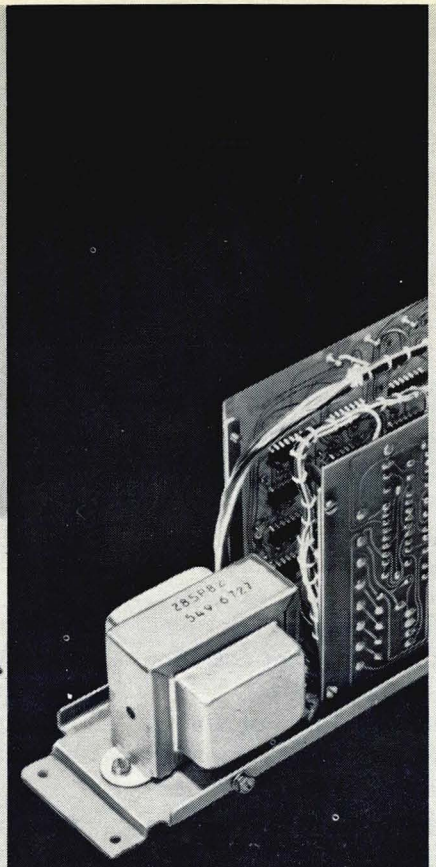


Maintaining a passenger flight manifest is a vital part of airline operations. And highly complex. One carrier, that deals with hundreds of flights and some 25,000 people daily, recently reduced some of the problems involved by integrating high-speed Teletype® equipment into its system.

Computerized manifest data, compiled in the airline's central office, is sent to departing terminals two hours prior to each flight. It's used in a variety of ways: As a boarding checklist. In computing aircraft weights and balances. For meal details. To meet special requests for wheelchairs, etc.

At the time of departure, "no show" passengers are deleted from the manifest, standby names on board are added, and the list resubmitted via Teletype equipment to central office computer for updating. The computer then generates the "official" manifest and sends it to both departure and arrival terminals involved, at 1050 wpm. The send-receive operation usually is complete before the flight gets into the air.

Teletype's Stuntronic™, electronic selective calling station controllers, also helped reduce computer port requirements of this system by 90%.



keeping a multistation network under control

Teletype has a simple solid-state logic device that provides a truly practical and economical way of establishing automatic control over multi-terminal data systems. The Stuntronic™ station controller is what it's called.

This helpful accessory provides station interface, control, and response for all ASCII compatible Teletype data terminals. Can be used with model 33, model 35, model 37, Telespeed™ and Inktronic® equipment. It will recognize all incoming station signals and respond to its own address characters.

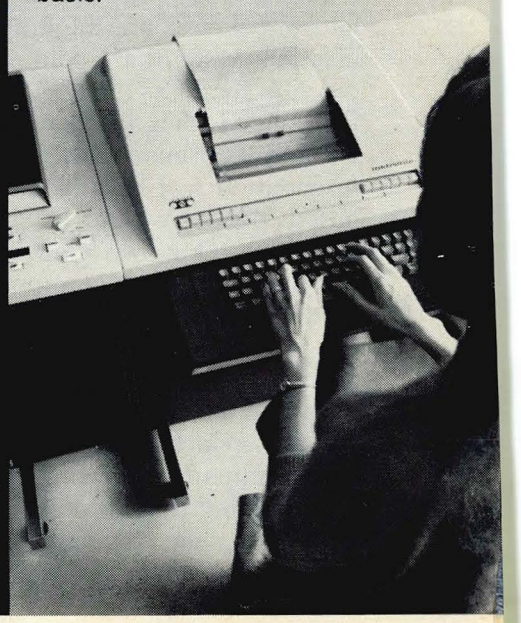
More than 100 different control arrangements are possible with the Stuntronic station controller — including detecting vertical parity errors and establishing computer communication and intra-circuit communication among a variety of system terminals.

total on-line time: divide by twelve

If you have a number of low-speed terminals in your time-sharing system that generate heavy loads of on-line time, it may pay dividends to do the above arithmetic. The Teletype Inktronic terminal is about twelve times faster.

This electronic, solid-state terminal will generate 128 ASCII combinations. Print 93 alphanumerics in upper and lower case. It achieves 1200 wpm printing capability. Charged ink droplets are drawn to the page through a series of electrodes that form the character called for. The ink supply and guidance system has only one moving part. So the Inktronic terminal requires little maintenance. And it's really quiet.

It has more than on-line operational economy, too. Uses ordinary teleprinter paper. And inexpensive ink. Like most equipment in the Teletype line, you won't find a more capable terminal on a price/performance basis.



on track with 80,000 cars

Numbers: important in every business. But, no one has to contend with more of them than a railroad. Keeping the digits straight that identify rolling stock alone, staggers the imagination. These numbers represent big money to railroad and customers alike.

One major railroad uses over 500 high and low speed Teletype terminals in its system to provide the type of car utilization that means business and profitable operation. The terminals are linked to a computer by communications channels.

The Teletype equipment has parity error detection capabilities. Important in keeping the identity and location of over 80,000 cars straight. Teletype solid-state terminal logic permits the computer to poll stations and terminals to respond automatically.

Data generated includes immediate car availability, projected car availability in 1 to 3 days, condition of cars, what type of goods each can handle. Locomotive power available. Enabling the railroad to provide shipper customers the equipment they need for loading, when needed. The data system handles over 30 million data bits daily.

recommended reading

Teletype has a number of brochures on equipment, applications, and case history data. A short description of what is available is contained in: "How to get answers to your questions about Teletype equipment." Write for your copy.

Teletype data communication equipment is available in send-receive capabilities of up to 2400 words per minute. Included are hard-copy, magnetic-tape and paper-tape terminals, error control devices, options and accessory equipment to fit most data communication system requirements. For information write:

TELETYPE CORPORATION
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machines that make data move
Teletype is a trademark registered in the U.S. Pat. Office

COMMERCIAL MINI SYSTEMS REVISITED

THOMAS DeMARCO, Vice Pres. • Mandate Systems, Inc., New York, N.Y.

About one year ago, I wrote on commercial mini systems in this column. At that time, I said that IBM's new System/3 was not the answer to any maiden's prayer, but that the California Office Systems Computer was. In the interim, Cal Systems has gone out of business and IBM has not. For farsighted insight I get less than 100%.

I had chided IBM for unreasonably abandoning standards with the System/3, for being card-oriented, for not offering upwards compatability, and for sticking users with a dog of a language like RPG. I still agree with all of that. But the System/3 users I have talked to are well pleased, even ecstatic. Happy users these days are about as rare as happy investors, and I conclude that the system's virtues outweigh its faults.

Those virtues are considerable and typical of IBM: high-quality peripherals, continuing dedication to product development, and impeccable service. (The service is the most important; and after observing it for all these years, it still astounds me. My own IBM representative is the most perceptive and user-conscious vendor I have ever encountered.) Software is less than elegant but more and more abundant. The price is competitive. The range of applications is enormous.

My infatuation with the Cal Systems computer was based on two things: its peripherals and its turnkey applications. The peripheral that particularly pleased me (and still does) was a tape cassette unit OEM'ed by International Computer Products in Dallas. That device was, in my opinion, the first real mini-peripheral having price and function consistent with the needs of a mini-user.

In order for a mini system to be viable in the commercial environment it must have the peripherals to make it usable. These include a good printer, tapes, and perhaps a sense mark reader or the like. The other essential is a set of ready-made applications packages. A complete turnkey operation is best; a reasonable commercial programming language is a minimum necessity. Assembly language is not a reasonable commercial language.

Cal Systems was the first to assemble something that could be marketed to small commercial users. In the past year a few other bright minds have put together good workable commercial mini-systems.

The strongest approach comes from the Digital Equipment Corp. Their Business Aid System is built around a PDP-8. (What can't you do with a PDP-8?) The new DECwriter printer is obviously destined to fit into the Business Aid System. The system currently uses DECtapes, but a change to cassettes would not be a surprise.

Package software includes Accounts Receivable, Payroll, General Ledger, Inventory, and Sales Analysis among others. Best of all is a shorthand Cobol called DIBOL which can be used to round out the already generous package set, and for some customizing.

DEC also offers some full turnkey variants of the system for users like office products distributors, fuel oil dealers, etc. Prices are $60,000ish including a DECpack disk. The garnish is typical DEC solidity and fine service.

EDP Technology of Orlando, Florida has a very pretty little commercial system in their CBS-4/5. The CPU is a NOVA by Data General. The system features a Univac "circular saw" printer and tape cassette drives (ICP again). The user operates on-line with programs like General Ledger, Detailed Journal, Balance Sheet, Income Statement, Accounts Receivable/Sales Analysis, and Payroll. All that in a desk cabinet for $24,000. There's even a stripped-down version for $16,090. Clever people, these Floridians.

Automated Business Systems has put together the ABS/1231 around some nicely user-oriented devices of their own design. The system comes in turnkey form for such applications as Production Planning and Control, Payroll and Accounting, and Hospital Accounting and Analysis.

Where people are doing things right, IBM is never far behind. The latest activity in the System/3 area is to put the user back on-line (S/3, Mod. 6), where a small machine user belongs. New peripherals like the ledger card handler are oriented toward the businessman. Turnkey operations are the new vogue, and as everyone has heard (except at IBM), there seems to be a System/3 Cobol alive and well in Poughkeepsie.

Exciting things come from thinking small. Today the world, tomorrow the drugstore. ▲

Thomas DeMarco is a regular contributor to **Systems Scene**

Full line buffer. Interfacing. 6-copy printout. 400 lines per min.

$7,800.

Don't pay extra for the extras.

Why pay extra for the extras? If your mini-computer is a PDP-8, Nova, HP-2116, Varian 620, Honeywell 316 and 516, just plug us in. Our Vogue/Shepard 880E Printer can be connected immediately. And it's equipped with a full 80 character buffer, MOS memory, IC logic circuitry and complete interfacing including connectors, cables, computer interface cards and software. All for the price of the printer itself.

Without interfacing, the complete system is available for only $7,000 installed!

What's more, the 880E Printer incorporates our uniquely designed combination of ink roller reliability and patented, drum-impact, ballistic hammers to produce six clear copies of data. Five more copies than you get with non-impact printers. At no extra cost.

The Vogue/Shepard 880E Printer

For $7,800 installed, our 400 lpm printer costs a lot less and does a lot more than any competitive printer around. Quantity pricing available, of course.

For information about the printer with the built-in extras, write: Shepard Division/Vogue Instrument Corporation, 131st Street at Jamaica Avenue, Richmond Hill, New York 11418. (212) 641-8800 TWX 710-582-4796

CIRCLE NO. 15 ON INQUIRY CARD

HOW TO SPELL MIS

KEN FALOR, Dir. Mktg. Services • Cullinane Corp., Boston, Mass.

Although the only sure thing that can be said about a Management Information System (with capital letters) is that it is a System for providing Information to Management, there are many economically practical and functional management information systems (with small letters) around and doing quite well. I refer to those that have gone above and beyond the normal call of duty by furnishing special information to management on request. Through this door we enter the realm of the "Special Request MIS/mis." (While most business systems on a computer provide information for management, MIS (or mis) is generally taken to mean a nice neat way of obtaining non-standard information.)

WHERE AND HOW

Sometimes Special Request needs can be met with information already "up" (located in a file). Sometimes it involves putting more information up. Once the "where" is taken care of, we must deal with the "how" – getting it out in the form desired. Sometimes this can be done with systems that get it to the manager in a few hours, on paper. Another way, more elegant in concept and also more expensive, is to get it to the Manager (note capital letter) in seconds and on the face of a CRT display.

So, for our purposes at least, we can define **mis** as a system for getting information on paper to a manager in hours, and **MIS** as a system for getting Information on a CRT to a Manager in seconds.

We will further qualify our MIS by calling it a "Special Request MIS" to distinguish it from modeling and gaming systems, as well as from systems that involve rather large reorganization and/or centralization of file structures and files (including the "data base management system"). These systems are really independent of the Special Request MIS and mis that we are talking about, although they may interface with them.

The Special Request mis is often developed by simply utilizing a good report generator or file management system to minimize response time and relieve the pressure on the programming staff. This is a fascinating and expanding field of information systems technology.

The Special Request MIS is accomplished by putting files on disk and installing a TP facility to access them, a bigger computer to handle them, an on-line software system to control them, and a black box on a Manager's desk (along with an instruction book boiled down to Dick and Jane simplicity) to retrieve them.

We deplore the currently fashionable tendency to overlook the first of the above ways, and even to overlook both of the above ways to solve special request problems. Each oversight can affect the budget by a factor of ten. Lately, the first instinct seems to be to go **all** the way; i.e., to merge all information into one monster file and install a data base management system to handle it so one black box can access everything in the company for the MANAGER (all capital letters now). However, this may not be the answer at all to the special request, as you and your MANAGERS may bitterly find. The reason is simple: the bigger the file, the longer the access time. Your data base management system may use an almost infinite number of special file structures (including chaining) and access methods – but these are effective only if you ask the right questions. Many a MANAGER asks questions that require going through nearly every record of a file. *Alors!* Back where you started. And after you just spent $500,000 (conservatively) on the monster.

BEFORE YOU LEAP

If the principle goal is only to satisfy the Special Request (however complex), we feel that going to a common data base system and sometimes just going to an on-line system can be a matter of technological overkill. There are, of course, exceptions: the gigantic files necessary for on-line customer inquiry systems or special military and business strategy applications (where seconds really do matter!) are unavoidable. But just remind yourself and your manager that the difference between a 5-second and 5-hour response to a special request may be half a million dollars or so. Is it really worth it? ▲

Ken Falor is a regular contributor to **Software Forum**

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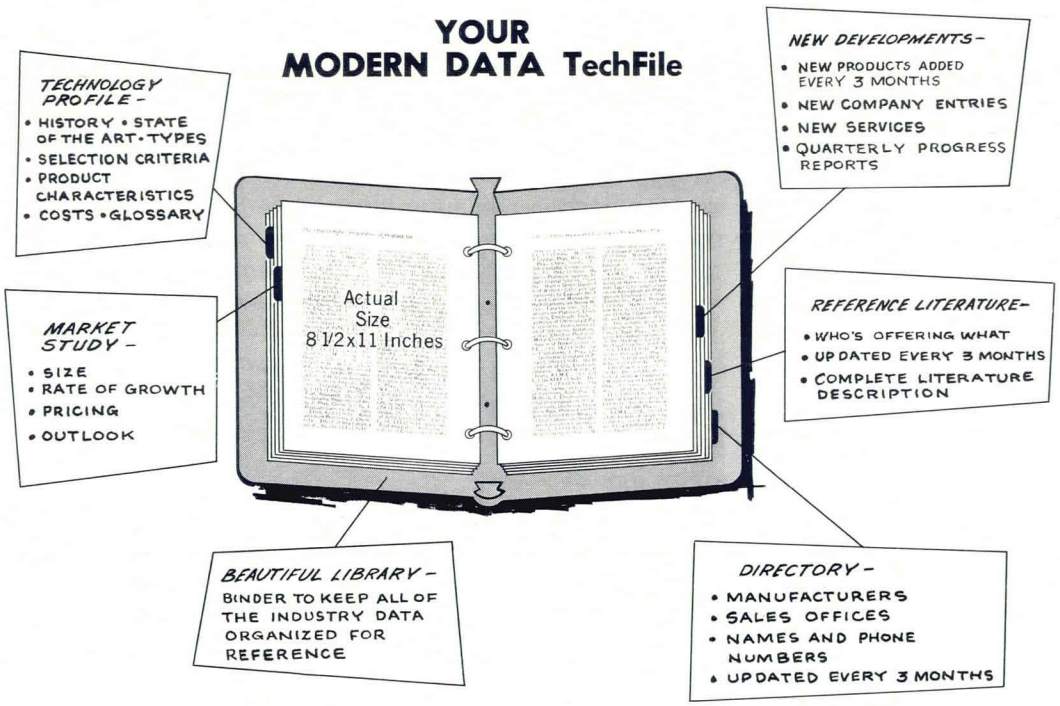
____(426) Optical Character/Mark Readers
____(427) Disk/Drum Memories
____(428) Teleprinters
____(429) Computer Printers
____(430) Modems/Multiplexers
____(431) Minicomputers

INQUIRY CARD NO.

____(432) Magnetic Tape Transports
____(433) Digital Plotters & Drafting Machines
____(434) Graphic Digitizers
____(435) Key-to-Tape/Disk Systems
____(436) Time-Sharing Services — S. Atlantic & S. Central States
____(437) Time-Sharing Services — N. Central States & Central Canada
____(438) Time-Sharing Services — Mountain States, West Coast & W. Canada
____(439) Time-Sharing Services — Northeast States



MODERN DATA's Technology Profiles are probably no stranger to you. In accordance with MODERN DATA's policy, they're written **by** computer people **for** computer people. Now the TechFile updates will let you **stay** abreast of the changes in the subjects or products that concern you most. Publication for a number of the titles is imminent. The cost will run from $45 to $60 a title for a **full year's service** once they're published. Inquire **NOW** and you can **save up to 44%.**

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ONLY MAMAS GIVE GOLD STARS

Up the System Down-Time fans will welcome Fritz Kinderhaufen as he takes a macro view and a surgeon's scalpel to the twin subjects of privacy and reputation.

FRITZ KINDERHAUFEN • Lajitas Mgt. Assoc., Alpine, Texas

We systems people are about to become the prime target in one of the most pivotal controversies since Immanuel Kant critiqued pure reason.

My intent is not to alarm systems people or make anyone wish that he weren't in the systems game. But as a systems man, you should be aware that a fight is about to take place. So take a side **now** to avoid getting caught in the cross-fire.

The problem deals with a subject of tremendous personal significance to every man alive. It is an emotion-ladened issue which transcends pure materialism and strikes at the very core of a man's pride. What could be all that important? The answer is very simple: **Every Man's Reputation.**

Put this article aside and forget it if you will, but my bet is that you will have cause to reflect upon this matter relative to your own reputation before too many years pass.

WHY YOU?

You are the man who developed computerized systems for keeping track of a man's reputation. You have been responsible for maintaining credit records of individuals and companies for years. You are now putting together systems to keep track of criminal suspects and health records, vital statistics and tax records, security evaluations, and general aptitude scores.

Up until now these records have not been put together well enough to frighten many people, but technology draws nearer the time when they will be put together all too well! Nor will our legislators prevent this from happening as they attempted to do in 1967 when Congress killed the resolution for a national data bank. Information about a man's reputation is too valuable to be ignored or postponed. Too many important decisions, such as hiring, mortgage loans, insurance applications, and even national security, hinge upon it. There is no doubt that we will continue to keep records on people's reputations and that we will continue to increase the amount of information recorded.

SOMEBODY UP THERE IS TALKING ABOUT YOU

There is one aspect that is likely to change. Heretofore almost all the information we kept was maintained for our files (and the files of anyone with whom we chose to share it), but was generally **not** available to the individual in question. As records on a man's reputation become more complete and more widely available, it is almost certain that the subject of these records will insist upon the right to see them himself. And he will want all those nasty little codes translated.

He already suspects you of doing an incompetent job of keeping the debits and credits straight on his credit cards, but his reactions have been mild compared to what he will do if you fail to keep the record straight on his reputation.

Have you ever noticed how you get on mailing lists? Have you ever wondered what by-products could result from your resume once it has been placed in a personnel search data bank or a dating service file? Don't get up tight; I just wondered if you had ever thought about it.

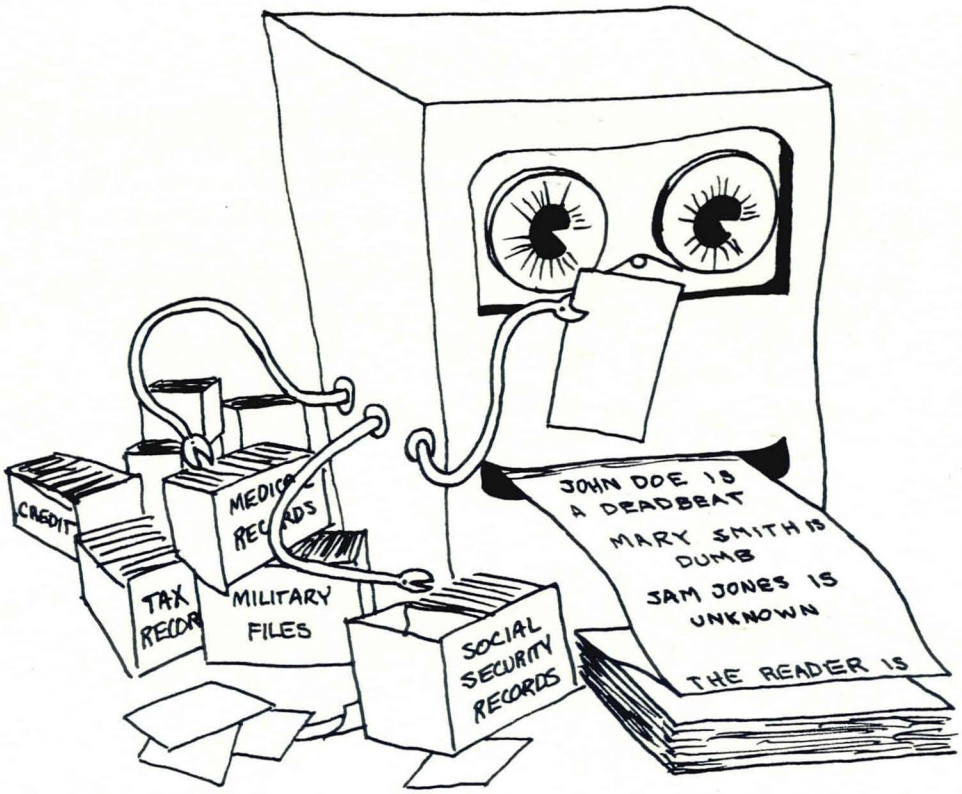
If you have, you've probably shrugged your shoulders at the scope of the inquiry. How do you find out who bought all the mailing addresses, or how well your credit files are updated? Who has access to them?

You, the systems manager, are the best qualified investigator to pursue the task and determine what records are maintained on you.

THE POSITIVE POWER OF THE NEGATIVE STING

There has been increasing attention to the question of privacy and the computer. There will be even more attention as the public becomes aware of the potential for good and bad that a **Reputation Bank** can bring.

The present laws which seem most applicable are those dealing with slander and malicious gossip. It is doubtful that we will get into trouble for keeping records on a man's reputation provided that anything we say about him is either honor-



able or true. Generally, we get into trouble only when we say things about a man which are neither honorable nor true (or are no longer true).

Anyone who has ever done much thinking about the **right** of privacy realizes that we seek privacy only on the things we don't want other people to know, and publicity for everything else. Few people would object to a data bank which contained only nice information and which automatically rejected updates of an unfavorable nature.

It must be remembered that almost all records maintained on an individual bear upon the negative aspect of his activities. No gold stars are awarded when he pays his debts, sends his children to school, and stands tall in his community as a paragon of virtue; only mamas give gold stars. Mr. Everyman has no PR department or slick ad agency which can offset the negative fact that he forgot to mail his mortgage payment just before he left for a well-earned vacation.

If we realize that we are in the business of awarding demerits only, then let us program as if our own reputations depend upon it.

PREDICTION

It can be predicted that the **Reputation Banks** which are already here will be enlarged and become more mutually addressable. The public will demand and gain the right to know what is on the record.

Companies which maintain and exchange records bearing on reputations will find themselves involved in liability suits which will make front page headlines across the country.

We have always been very aware of the need for systems controls when we account for dollars. In the future we must become even more alert when we account for reputations.

Remember: the reputations we save may be our own. ▲

You are invited to take a moment from your other duties next month to scan (optically) Mr. Kinderhaufen's thesis re systems organization recruitment problems: "The Low-Pass Filter and Other Hang-Ups."

PUSHBUTTON TELEPHONES

LAWRENCE A. FEIDELMAN, Vice Pres. • Information Spectrum Inc., Cherry Hill, N.J.

Let us examine a low-cost, widely available source data automation device which is as simple to use as your telephone. In fact, this device **is** your telephone. Specifically, the push-button model offered by the Bell System under the name of Touch-Tone telephone (Fig. 1). Its most important characteristic is that it can be used for entering data as well as voice messages.

Applications which take advantage of the Touch-Tone telephone's data input capabilities are already well-known. When used as a credit-checking device, for example, it results in faster and more accurate verification. As a sales tool, it provides an immediate means of determining the availability of ordered items and expediting their delivery.

Its socio-economic implications are enormous. Every home and office has potentially a computer data entry device in the form of their telephone. Dependent housewives and handicapped persons can now join the work force by performing keypunching jobs at home. Extensions of this application give each of us access to a computer system for store ordering, budget planning, check balancing, personnel identification, bill payments, and even income tax calculations.

HOW THEY WORK

The Touch-Tone telephone generates and transmits frequencies or tones as buttons are depressed. A multi-frequency coding system, 2 groups of 4 frequencies each, permits up to 16 separate button depressions (with only 12 buttons presently being used). Fig. 2 shows a Touch-Tone pushbutton arrangement. Numeric characters only require a single depression of the buttons, whereas alphabetic characters require two or three depressions. In the latter case, the alphabetic character is defined by the control characters *, *#, or # followed by the alpha character button. For example, to enter A1B2C3 you would depress *21*#22#23 in that order.

Another way to enter data is by using prepunched plastic cards. Each card can contain 14 digits or characters which can be read at a rate of approximately 8-½ characters per second. The card characters can be divided into fixed fields between which variable data can be entered at the keyboard.

In areas where telephone central exchanges have not been modified for Touch-Tone service, an auxiliary Touch-Tone pad can be connected to the rotary dial handset. The call is placed through the exchange by dialing normally, and the buttons are used to input data after the circuit has been established.

OTHER PUSHBUTTON TELEPHONES

AT&T is not the only company which provides pushbutton telephones. **Photo-Magnetic Systems, Inc.,** for example, manufactures a computer data entry pushbutton telephone called COMPUT-A-PHONE, which is similar in operation to the above-mentioned Touch-Tone system. Another company, **Transcom Products,** manufactures several models of pushbutton terminals which vary in their mode of transmission and optional features. Options include a strip printer for visual verification, and an audio answer-back capability.

AUDIO ANSWER-BACK

An audio answer-back system responds to the caller in pre-defined patterns of tones or in machine-generated speech. This latter capability requires a voice response system at the computer end. Voice response is especially valuable for bank account or store credit checks when the exact account balance is required, or for applications requiring short inquiry response messages (e.g., stock quotations, weather forecasts, news reports, and production data checks).

OPERATING PROCEDURES

Combining all the above features together, a possible user procedure might be:

(1) Call is made to computer system to establish connection, and audible acknowledgement of connection is received.

(2) Identification code is transmitted by user who then proceeds to transmit data via prepunched card and/or pushbuttons. (Further acknowledgement may be provided.)

(3) User transmits end-of-message code.

Lawrence Feidelman is a regular contributor to **Source Data Automation**

Fig. 1. Bell System Touch-Tone Telephone

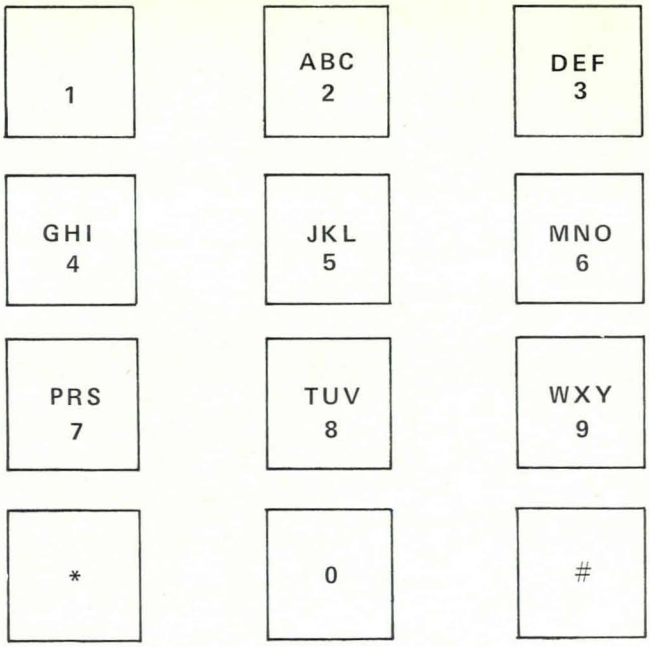


Fig. 2. Touch-Tone Pushbutton Telephone

(4) Depending upon the remote facility configuration, an acceptance or rejection tone and/or verbal repetition of message may be received, at which time user terminates call by replacing receiver.

COST

The cost of pushbutton telephones is dependent upon the manufacturer, telephone location rates, and attachments. Monthly rentals run from approximately $7 for the basic pushbutton phone to $30 for a model which includes hard copy printout, a card dialer, and an audio answer-back capability. These prices, of course, do not include special interconnecting devices or the voice response system at the processing location. ▲

TIME-SHARING SERVICES—REGION I

New England and Mid-Atlantic States; Eastern Canada

EDITOR'S NOTE: This Profile updates the February survey and initiates a new series on time-sharing services. A departure from previous Profiles will be the tabulation of vendors on a regional basis — the U.S. and Canada being divided into four regions. This first Technology Profile covers time-sharing services offered in Region I — The New Engand States, the Mid-Atlantic States (N.Y., N.J., Pa.), and the Eastern Canadian Provinces (Que., the Maritimes) — and discusses software development as a user application for time-sharing. Future Profiles (published on a quarterly basis) will cover the other regions of the U.S. and Canada, and discuss such areas as data-base applications, special time-sharing services, and software.

COMPARING SERVICES

The question of pricing time-shared computer services is a difficult one. Some vendors charge for CPU and connect time, others charge a quantity which is a function of CPU time, connect time, amount of core memory used, and I/O data channel usage. Since there is no standard unit of computer power, the best way to compare vendors is to run benchmark tests which apply to a variety of system uses under varying load conditions. The benchmarks should test the following: **1.** CPU-bound programs; **2.** I/O-bound programs; **3.** Balanced programs; and **4.** Programs driven by user response to terminal output.

ROBERT J. KOLKER has over eleven years experience in programming and mathematical analysis. He has a B.S. in Mathematics from Syracuse Univ. and an M. S. in Mathematics from the Univ. of California. Prior to his employment at Interactive Data Corp., he held positions with Mitre, Honeywell, and Lincoln Labs.

The benchmarks should be applied at different times of the day to reflect the effect of different loads upon the system. Benchmark 4 gives the user an indication of the responsiveness of the system under test. This is of particular importance to data-base query programming and on-line program debugging.

In addition to specific system attributes, the quality of telephone service to a vendor's computer facility must be judged. The reliability of connection, frequency of busy signals, amount of line noise, and cost of connection must be included in any selection of time-sharing vendors. Bear in mind that the computer services offered is no better than the telephone connection to that vendor.

Once the user has decided time-sharing is the best route to follow, how does he choose among several vendors? This choice depends largely on the user's purpose or application. This Profile series divides applications into three non-exclusive areas: Software Development; Data-Base/Related Applications; and Special Services and Software.

Software development will be discussed in this Profile; the remaining areas will be covered in subsequent Profiles.

SOFTWARE DEVELOPMENT

Software Development is still the major use to which time-shared computer systems are applied. The reader may wonder why one should do software development on a time-shared computer facility when the cost of such services is relatively high? The basic reasons are the increased availability of computer services to the programmer; and the drastic reduction in the program test-program correction cycle.

The effect of this reduction is quite striking. In a batch-processing facility, a programmer may get 1 to 5 "shots" a day; in a time-sharing facility, he may get 30 to 50 "shots" a day. Consequently the batch-processing programmer must multiprocess his mind, and work on two or three programs at once to achieve efficiency, whereas the time-sharing programmer can work on a program until it performs correctly. Humans are not particularly efficient at multi-processing their minds, and such shifting reduces mental concentration and effi-

ciency per-job. By wall-clock time a programmer can do a job on a time-sharing system from 4 to 10 times faster than on a batch system.

On-Line Debugging

The key to reducing the test-correction cycle is the use of on-line debugging facilities. The type of aid found in batch facilities requires the programmer to decide ahead of time what type of dumping and tracing will be done at run time. The on-line debugging facility enables the programmer to interrupt his run asynchronously and insert additional trap and trace instructions not originally planned when the debugging strategy was first formulated.

In addition, on-line debugging facilities usually permit the programmer to set up his breakpoints and traces without modifying the source program or text deck. This differs from the "trace-on," "trace-off" statements that must be inserted in the source deck at compile time. Some time-sharing vendors offer very sophisticated debugging aids which permit symbolic debugging – reference to memory locations and registers using the same symbols as in the source program. Some even permit run-time patching so the corrected program can be run and tested before a recompilation or assembly is done.

This type of debugging facility is the lineal descendent of console debugging systems popular with users of mini-computers. In effect the time-sharing system gives the programmer his "own" machine, and transforms his terminal into a virtual machine console.

There is a danger to all this convenience. The discipline of inferrential debugging and desk-checking tends to erode. There is a tendency to try program fixes without thinking through all the consequences. Also, the presence of on-line diagnostics tempts the programmer to ignore the desk-check. This type of sloppiness can run up a rather large computer bill.

Test Generation

Another facility useful to software development is test data generation. Again, such facilities are available at batch processing installations, but the ease of file creation and manipulation in the time-sharing environment enhances the usefulness of this kind of test aid.

If the software development application involves more than one programmer, the user should see if the vendor offers a system of file-sharing. The technique of making a programmer's source, text, and data-files available to his team mates corresponds to cataloging data-files in a batch processing facility.

Target Environment

If the ultimate environment is non-time-shared, or the product is to run on an in-house installation, the user must determine the ease of conversion from the development to the target installation. Some degree of compatibility is required between the development and target system.

If the compatibility is achieved through machine independent programming, the user must see if the vendor offers high-level language support (PL/1, Fortran, Cobol, etc.). If such support is available, then the specific attributes of the target environment must be present or simulatable in the development environment.

The user may require compatibility at the machine level. If this is so, the vendor should provide macro and assembly language facilities. Usually the machines for development and target usage are of the same make.

Core Memory Management

Most time-sharing systems provide a virtual memory to the user, that is, a range of addresses which bears no necessary relationship to the actual range of addresses which are used at run time. There are two kinds of environment – memory paging and non-paging. In a non-paged environment, the amount of virtual memory available to the user is less than that of the physical machine on which the system is run. This usually means the amount of core available to the user at any one time is less than his total requirement. In this case he will require some form of program overlay (either dynamic or static) to run a set of programs.

Overlay management requires a loader which is more elaborate than the straight-forward relocat-

able loader. The user should be aware that program design must take into account overlay design and the resultant run time increases due to swaps of overlay segments.

If memory paging systems, special hardware is used to translate the users virtual addresses into real machine addresses when his program is run. In such systems, it is possible for the virtual memory to exceed the actual memory of the machine being used. The user may design his program modules somewhat more freely since he can specify very large virtual memories for his run time environment. He can design his program modules independent of overlay management restrictions. On the other hand, restrictions in the target environment may force the user to forego the advantages of paging.

Job Control

Anyone who has used Job Control Language in OS knows that run setup can be very complicated and error-prone. Most time-sharing systems have task initiating commands whose syntax is much simpler than those found in batch process job control languages. In addition, time-sharing vendors offer executive file capability (i.e., the user can create a file consisting of terminal level commands and conditional transfer statements which constitute the task management logic). The executive file can be invoked, and tasks specified within the file are initiated automatically. Conditional statements within the executive file can cause tasks to be skipped or re-initiated according to the conditions stated. In effect, the executive file transforms the user's terminal into a "player piano."

Some vendors offer a dormant-run capability (i.e., the user may initiate a task or invoke an executive file and then disconnect his terminal). The execution of the users task(s) either completes successfully, or is terminated by an abnormal condition or by a watch-dog timer which prevents a run from going indefinitely. Such features are available in batch systems, but the time-share environment gives the user the choice of working interactively (terminal connected) or in the manner of remote job entry (terminal disconnected after task initiation). The user should inquire about this dormant-run capability since it reduces connect time charges.

Text Editing

Time-sharing vendors offer text editing facilities of varying degrees of sophistication. For software development, the basic requirement is a line editing capability (i.e., the editor enables the programmer to insert, change, or delete entire lines of text). More sophisticated editors provide context editing facilities where one can make changes in a specified context rather than handle entire lines of text. Context editors usually have facilities for making global changes (i.e., changes for all occurrences of a character string in a specific context wherever such occurrences are throughout the entire file). Text editing used in conjunction with compiler (or assembler) make quick work of removing syntactical errors from source programs. Gone is the annoyance of losing a half day because of a missing comma.

Attachments

A feature which is useful where large source files are required is the ability to attach a card reader, punch, or a magnetic tape to the user while he is on-line. Not all vendors offer this capability, and some require that the user load card decks at night when the system is not available for time-shared usage. The ability to load data files via a card reader gives the user the option of having his source (or data) files key-punched off-line, then edited on-line. As a rule, key-punching is cheaper than source file creation on-line.

THE TABLES

Table 1 lists the vendors who offer time-sharing services in Region I — New England, and Mid-Atlantic States, and the Eastern Canadian Provinces. Local offices, where a user may tie in either directly with the central processor (c), or with a multiplexer (m) to avoid excessive telephone tolls, are listed along with the states and provinces serviced. Parameters on facilities, terminals offered, charges, file structure, software, applications packages, and data bases are tabulated for each vendor. To obtain additional information, use Table 2 or call the nearest local vendor office.

▲

Data-base related applications will be discussed in the next Time-Sharing Technology Profile, which will cover vendors in the South Atlantic and South Central States (Region II).

TABLE 1 • TIME-SHARING SERVICES—Region 1

COMPANY	Allen-Babcock Computing	Applied Computer Time Share	Applied Logic	Axicom Systems	Bowne Time-Sharing	Burlington Management	Community Computer
REGION I Area Serviced	New England Mid Atlantic	NY	Mid Atlantic Ct, Ma	Mid Atlantic Ct	Mid Atlantic Ct, Ma	New England Mid Atlantic	NJ, Pa
Local Offices	Union, NJ (c) NYC (m) Bos (m) Phil (m)	Binghamton (m)	Princeton (c) NYC (m), Buf (m) Bos (m), Phil (m) E. Orange (m)	Paramus NYC	NYC (c) Bos (m) Phil (m)	NYC (m)	Phil (c) Scranton (m)
FACILITIES CPU	IBM 360/50	GE-440	DEC PDP-10 (2)	UNIVAC 1108/ex8	IBM 360/40	RCA Spectra 70/46G	HP 2116B
Size	128K bytes[1]	64K @ 24 bytes	128K @ 36 bits	131K @ 36 bits	256K	256K char.	16K words
Core to User Program	32K	22K	32K	70K	128K	1M bytes	5.44 words
No. Users	—	50	50	—	100	48	32
Response Time (peak/non-peak use)	3/1 sec.	—	—	—	—	4/0.1 sec.	1/0.1 sec.
TERMINALS	TTY, CRT, Printers, Plotters	TTY, CRT, Plotters	TTY printers, Plotters, Card Equip.	TTY, CRT, Printers	TTY	TTY, CRT, Printers	TTY
CHARGES Minimum/Mo.	—	—	$100	$150[1]	—	$100	—
Connect/Hr. (prime/non-prime)	—	$9.50/$5.00	$10.00	$10.00/$5.00	$2.15	$12.00	$7.00
CPU/Min. (prime/non-prime)	—	5¢/3¢	[1]	$8.40/$4.80	0.8¢/120m sec.	60¢	—
Disk Storage/Mo.	—	$1.00/1K char.	75¢/1024 char.	—	$25/1550 bytes	$6.00/25K bytes[1]	10¢/sector[1]
Tape Storage/Mo.	—	—	10¢/1024 char.	16¢/reel[2]	$1.60/1000 records	$3.00/tape	—
Other	—	—	—	4¢/10,752 char.[2] Drum	$5.00/reel read	—	—
FILE STRUCTURE	Index Seql.[2] Random Partitioned[2] Seql.	—	—	Index Seql. Random	Random	Index Seql. Random Seql..	Index Seql. Random Partitioned
SOFTWARE	ALGOL COBOL-ANSI FORTRAN-IV GPSS PL/1	BASIC COGO FORTRAN-IV	AID BASIC COBOL-ANSI COGO FORTRAN-IV LISP SNOBOL MACRO-10	COBOL-ANSI FORTRAN-IV GPSS LISP SIMSCRIPT SNOBOL	COBOL-ANSI FORTRAN-IV PL/1	BASIC COBOL-ANSI COGO FORTRAN-IV	BASIC
APPLICATION PACKAGES	Business Financial Accounting Text Edit Engineering Scientific	Business Banking Financial Accounting Text Edit Printing Engineering Scientific Simulation Program Debug. Education	Text Edit Engineering Scientific Program Debug.	Text Edit Engineering Scientific Simulation	Text Edit Printing	Business Financial Accounting Text Edit Medical Engineering Scientific Program Debug.	Business Banking Financial Accounting Text Edit Printing Engineering Scientific Simulation Education
MULTI-USER ON-LINE DATA BASES	Financial	—	—	—	—	—	—
OTHER COMMENTS	[1] 2MK bytes (LCS) [2]Background		[1]Not Based Solely on Time	[1]Usage-Excluding Connect Time [2]per day		[1]First 50K bytes are Free	[1]80 words/sec. to 1K sectors, then 2½¢

TIME-SHARING SERVICES—Region 1 . . . . Cont'd

COMPANY	Computer Complex	Computer Dynamics	Computer Sciences	Computer Solutions	Comp/Utility	Com-Share	Consolidated Computer
REGION 1 Area Serviced	NJ, NY	Ma	Mid Atlantic Ct, Ma Que	Mid Atlantic Ct	Ma, NH	New England Mid Atlantic Que	Ma NY, Pa NS, Que
Local Offices	NYC (m) Crawford, NJ (m)	Bos (m)	NYC (c) Elmsford, NY (m) Bos (m), Phil (m) Hart (m)	E. Orange, NJ (c) NYC (m) Princeton (m)	Bos (c)	Norwood, NJ (c) NYC (m), Bos (m) Phil (m), Pitts (m) Rochester, NY (m)	Montreal (c) Halifax (c) Bos, NYC Reading, Pa
FACILITIES CPU	XDS 940; Sigma 7	AL/COM AL-10 (2)	UNIVAC 1108	HP 2000A	DEC PDP-10	XDS 940 (4)	HP 2000A
Size	64K words	128K @ 36 bits	196K words	16K words	64K @ 36 bits	64K words	32K @ 16 bits
Core to User Program	16K words	32K	20K	54K char.	32K	16K	8K
No. Users	42	50	—	16	40	—	16
Response Time (peak/non-peak use)	3/1 sec.	—	—	1/0.5 sec.	—	—	5/0 sec.
TERMINALS	TTY, CRT, Plotters	TTY, CRT, Plotters	TTY, CRT, Printers, Plotters, Card Equip.	TTY, CRT, Printers, Plotters	TTY, CRT, Printers, Plotters	TTY, CRT, Plotters, Card Equip.	TTY, CRT, Printers, Plotters
CHARGES Minimum/Mo.	$250	$100[1]	$25	$100	—	$400	$50
Connect/Hr. (prime/non-prime)	$12.00	$10.00	$11.00[1]	$8.00/$4.95	$8.00/$5.00	$10.00	$7.50/$6.50
CPU/Min. (prime/non-prime)	$2.40	—	50¢/sec.[2]	—	$1.80[1]	$3.00	—
Disk Storage/Mo.	2½¢/1024 bytes[1]	75¢/1K char.	$1.00/3072 char.	$1.00/1K char.	50¢/1280 char.	90¢/word	12¢/128 char.
Tape Storage/Mo.	—	10¢/1K char.	15¢/tape[3]	—	$10.00/tape	$3.00/tape	—
Other	—	—	—	—	—	—	12¢/128 char. Drum
FILE STRUCTURE	Index Seql. Random	Index Seql. Random	—	—	Random	Index Seql. Random	Random
SOFTWARE	BASIC COGO FORTRAN-IV SNOBOL CAL	BASIC COBOL COGO FORTRAN-IV LISP JOSS MACRO-10 SNOBOL	ALGOL BASIC COBOL-ANSI COGO FORTRAN-IV GPSS SIMSCRIPT	AGOL[1] BASIC FORTRAN-II[1]	BASIC COBOL-ANSI FORTRAN-IV LISP	BASIC COGO FORTRAN-IV SNOBOL	ALGOL BASIC FORTRAN-II
APPLICATION PACKAGES	Business Banking Financial Text Edit Engineering Scientific Simulation Program Debug.	Engineering Scientific Simulation Program Debug.	Business Banking Financial Engineering Scientific Simulation Program Debug.	Business Accounting Medical Engineering Scientific Education	Business Banking Financial Accounting Text Edit Engineering Scientific Program Debug.	Business Banking Financial Accounting Text Edit Printing Engineering Scientific Simulation Program Debug. Education	Business Accounting
MULTI-USER ON-LINE DATA BASES	—	—	Building/Constr.	—	—	Financial Economic Building/Constr. Business Mgt.	—
OTHER COMMENTS	[1]PER DAY	[1]with 3rd Billing	[1]$10/hr RJE [2]$800/hr RJE [3]per day	[1]Batch	[1]plus 60¢/K		

TIME-SHARING SERVICES—Region 1 . . . . Cont'd

COMPANY	Control Data	Dialog Computing	First Data	GE Information Services Div.	Honeywell Information Services Op.	Interactive Data	Interactive Sciences
REGION 1 Area Serviced	Mid Atlantic Ct, Ma	Mid Atlantic Ct, Ma, RI	Ct, Ma	New England Mid Atlantic	New England Mid Atlantic	Mid Atlantic Ct, Ma, RI	Ma NY, Pa
Local Offices	NYC Phil, Bos Hart	Milford Ct (c) NYC (m), Bos (m) Phil (m), Pitts (m) Hart (m) Fairfield Ct (m)	Bos (c)	—	Bos (c) NYC (m) Phil (m)	Bos (c) NYC (m) Phil (m), Pitts (m)	Bos (c) NYC (m) Pitts (m)
FACILITIES CPU	CDC 6400	IBM 360/65	DEC PDP-10	GE 265; 635	HON H1648 (3)	IBM 360/67(2)	DEC PDP-10 (2)
Size	65K @ 60 bits	2.25M bytes	65K	—	32K words	512K bytes	98K @ 36 bits
Core to User Program	—	131K	33K	—	16K	512K (virtual)	33K
No. Users	—	140	63	200	48	—	—
Response Time peak/non-peak use	—	3/0 sec.	3/1 sec.	—	3/0 sec.	—	—
TERMINALS	TTY, CRT	TTY, CRT, Printers, Plotters, OCR, Card Equip.	TTY, CRT, Printers, Plotters	TTY, CRT	TTY CRT	TTY, CRT, Printers	TTY, CRT
CHARGES Minimum/Mo.	—	—	—	$100	$90.00	—	—
Connect/Hr. (prime/non-prime)	$8.00	$10.00	$7.50/$5.00	$7.00-$8.50	$10.00/$5.00	$13.00/$8.00	$7.50
CPU/Min. (prime/non-prime)	20¢/sec.	$34.60	60¢/K core	—	$2.40/$1.80	$16.00	—
Disk Storage/Mo.	30¢/1280 char.	$1.65/2048 bytes[1]	39¢/K char.	—	$1.00/1024 char.	$25.00/150K bytes	$25.00/pack
Tape Storage/Mo.	—	—	$5.00/$7.50/tape	—	10¢/1024 char.	$10.00/hr. usage	$5.00/tape
Other	—	—	—	—	—	—	—
FILE STRUCTURE	—	Index Seql. Random	Random	Random Seql.	Random Seql.	Index Seql. Random Partitioned	Index Seql. Random Partitioned
SOFTWARE	ALGOL BASIC COBOL-ANSI FORTRAN-IV	BASIC COBOL-ANSI COGO FORTRAN-IV	BASIC COBOL-ANSI FORTRAN-IV	ALGOL BASIC COGO FORTRAN-II	BASIC COGO FORTRAN-IV	ALGOL APL BASIC COBOL-ANSI COGO FORTRAN-IV GPSS SNOBOL PL/1	BASIC FORTRAN-IV LISP
APPLICATION PACKAGES	—	Business Financial Accounting Text Edit Printing Engineering Scientific Program Debug. Simulation	Business Financial Accounting Text Edit Printing Engineering Scientific Program Debug. Education	Business Banking Financial Engineering Scientific Simulation Education	Business Financial Accounting Text Edit Engineering Scientific Education	Business Banking Financial Accounting Text Edit Printing Engineering Scientific Program Debug.	Business Banking Financial Text Edit Engineering Scientific Program Debug.
MULTI-USER ON-LINE DATA BASES	—	—	—	Financial Legal; Economic Building/Constr.	—	Financial Economic	Financial Economic
OTHER COMMENTS		[1]First 100;					

TIME-SHARING SERVICES—Region 1 . . . . Cont'd

COMPANY	Intermac	International Time Sharing	ITT Data Services	Keydata	Leasco Response		Mark/Ops
REGION 1 Area Serviced	NY	NY	New England Mid Atlantic	New England Mid Atlantic Que	New England Mid Atlantic	New England Mid Atlantic	Ct, Ma, Me, NH, RI NJ, NY
Local Offices	Rochester (m) Syracuse (m)	NYC (m)	Paramus (c) NYC (m) Pitts (m)	Bos (c) NYC (m), Hart Clifton, NJ, Garden City, NJ, Mont	Bos (c) NYC (c) Phil (c), Pitts (c)	Bos NYC Phil, Pitts	Bos (c) NYC (c) Prov (m) Hart, N. Haven
FACILITIES CPU	IBM 360/50	CDC 3300 (2)	IBM 360/67-65	UNIVAC 494	HP 2116 B (4)	IBM 360/65	—
Size	—	1M char.	—	65K words	32K words	512K bytes	64K @ 32 bits
Core to User Program	—	32K @ 24 bits	60K	—	10K	114K	36K
No. Users	—	120	—	800	16	—	64
Response Time (peak/non-peak use)	—	2/0 sec.	—	2 sec.	> 1 sec.	—	5/1 sec.
TERMINALS	TTY	CRT, OCR, Printers, Plotters	TTY	TTY	TTY, CRT, Plotters	TTY, CRT, Plotters	TTY, CRT, Plotters
CHARGES Minimum/Mo.	—	$100	—	—	$100	$100	—
Connect/Hr. (prime/non-prime)	$12.00	$10.00	—	—	$5.75	$9.00	$7.50/$4.50
CPU/Min. (prime/non-prime)	$6.00	12¢/sec.	—	—	—	$18.00	—
Disk Storage/Mo.	$10.00/32K char.	—	—	—	75¢/1024 char.	$1.00/3440 char.	—
Tape Storage/Mo.	—	—	—	—	—	—	—
Other	—	—	—	—	—	—	—
FILE STRUCTURE	Index Seql. Random	Index Seql. Random	Partitioned	Index Seql.	Random	Seql.	Index Seql. Random Partitioned
SOFTWARE	APL	BASIC COGO FORTRAN-IV	BASIC COBOL-ANSI COGO FORTRAN-IV PL/1	—	BASIC FORTRAN-IV	BASIC FORTRAN-IV PL/1	ALGOL BASIC COBOL FORTRAN-IV SIMSCRIPT
APPLICATION PACKAGES	Banking Financial Accounting Text Edit Engineering Scientific Education	Business Banking Financial Accounting Text Edit Engineering Scientific Simulation Program Debug.	Business Financial Accounting Text Edit Engineering Scientific Simulation Program Debug.	Business Accounting	Business Banking Financial Accounting Printing Engineering Scientific Program Debug. Education	Business Banking Financial Accounting Engineering Scientific Simulation Education	Business Financial Accounting Text Edit Printing Engineering Scientific Simulation Program Debug.
MULTI-USER ON-LINE DATA BASES	—	Financial Economic	Financial Economic	—	—	—	—
OTHER COMMENTS							

Our new teleprinter runs so quiet we had to fake a little noise.

Operators couldn't get used to the eerie quiet of the keyboard on our new TermiNet *300 teleprinter.

So we added a little noise to give them some "feel." Even then it's quieter than an office typewriter.

And when it's running as a high-speed printer from tape or computer it's quieter still.

A front-panel switch lets you select a speed of 10 characters per second. That makes it compatible with the leading communications terminal. Or a speed of 15 characters per second. That makes it compatible with the leading computer terminal.

Or its unique speed of 30 CPS. Which makes it compatible with your special requirements of data handling, and saves you money.

But quietness and speed aren't all. We've built a whole raft of versatile features into the TermiNet 300 printer. That way it'll take care of your needs for years to come.

Things like horizontal or vertical tab. Long-print lines—up to 118 characters. Pin feed. A transparent mode. Remote 20-character answerback. Parity check. Full/half duplex operation. And many more.

Most of these options are supplied as simple modular plug-ins.

Which brings us to the reliability of modular construction. It's very reliable. And that's backed up by General Electric's nation-wide service. A point worth considering. And considering again.

Whatever your needs—time sharing, information systems, computer-outputed editing and formatting, even just repetitive printing—the TermiNet 300 teleprinter is what you should specify in your present system. Or in your next. General Electric Company, Communication and Control Devices Department, P.O. Box 4197, Lynchburg, Virginia 24502.

GENERAL ELECTRIC

TermiNet 300 DATA COMMUNICATION PRINTER

*Trademark General Electric Company, U.S.A.

CIRCLE NO. 17 ON INQUIRY CARD

TIME-SHARING SERVICES—Region 1 . . . . Cont'd

COMPANY	McDonnel Automation		Mega Systems			Multicomp	Multiple Access General Computer
REGION I Area Serviced	NJ, NY	NJ, NY	Mid Atlantic Ct, Ma	Mid Atlantic Ct, Ma	Mid Atlantic Ct, Ma	Ct, Ma, RI NY	NY Que
Local Offices	NYC (m) E. Orange NJ	NYC (m) E. Orange NJ	NYC (c) Phil (c) Harrisburg	Phil (c) NYC (m) Harrisburg (m) Rochester(m)	NYC (c) Phil (m) Harrisburg (m)	Bos (c) NYC (m), Hart (m) Prov (m)	Montreal (m) Rochester (m) NYC
FACILITIES CPU	XDS Sigma 7 (2)	GE 430	GE 430	XDS 940	IBM 360/67	CDC 3600 (2)	CDC 3500
Size	96K words	24K words	32K @ 24 bits	64K @ 24 bits	128K @ 32 bits	256K @ 48 bits	131K @ 24 bits
Core to User Program	20K	10K	19K	11K	1024K bytes	32K	32K
No. Users	128	29	32	40	60	64	32
Response Time (peak/non-peak use)	—	—	1 sec.	1 sec.	< 1 sec.	—	1/1 sec.
TERMINALS	CRT	CRT	TTY, CRT Plotters	TTY, CRT Printers Plotters	TTY, CRT Printers Plotters	TTY	TTY, CRT, Printers
CHARGES Minimum/Mo.	—	—	$200[1]	$200[1]	$200[1]	$70	$10
Connect/Hr. (prime/non-prime)	$8.00	$10.00	$9.00	$11.00	$10.00	$10.00/$7.50	[1]
CPU/Min. (prime/non-prime)	$12.00	$3.00	$2.40	$2.75	$18.00	20¢/sec.	$10.00/$8.50
Disk Storage/Mo.	40¢/1024 char.	$2.50/1500 char.	15¢/180 char.	$1.00/1K char.	$10.00/120K char.	$1.50/2048 char.	60¢/4096 char.
Tape Storage/Mo.	—	—	—	—	—	—	—
Other	—	—	$20.00 Transfer	$20.00 Transfer	$20.00 Transfer	—	—
FILE STRUCTURE	Random	Random	Random Seql.	Random Seql.	Index Seql. Random Seql.	Index Seql. Random Partitioned	Index Seql.
SOFTWARE	BASIC COBOL-ANSI COGO FORTRAN-IV	BASIC COBOL-ANSI COGO FORTRAN-IV	COGO FORTRAN-IV	BASIC COGO FORTRAN-IV CAL	COBOL FORTRAN-IV GPSS SIMSCRIPT SNOBOL PL/1	BASIC COGO FORTRAN-IV	ALGOL COBOL-ANSI COGO FORTRAN-IV GPSS PL/1
APPLICATION PACKAGES	Business Banking Financial Accounting Text Edit Engineering Scientific Program Debug.	Business Banking Financial Accounting Text Edit Engineering Scientific Program Debug.	Business Financial Accounting Text Edit Medical Engineering Scientific Program Debug.	Business Banking Financial Accounting Text Edit Engineering Scientific Simulation Program Debug. Education	Business Banking Financial Text Edit Printing Medical Engineering Scientific Simulation Program Debug.	Business Financial Accounting Text Edit Engineering Scientific Simulation Education	Financial Engineering Scientific Simulation
MULTI-USER ON-LINE DATA BASES	—	—	—	—	Financial	—	—
OTHER COMMENTS			[1]For All Systems				[1]$8.00/110 baud $12.00/300 baud

MAC AND THE ELECTRON BEAM RECORDER

or

A Superswift Scribe Conquers the Computer

Stouthearted MAC 16 has won the day again! Consider, if you will, a high-resolution, on-line processing system that increases computer printout speed by a factor of 20. Truly, it staggers the imagination!

The manly fellows at 3M have resolved the printout logjam with their Series F Electron Beam Recorder. And what part, you ask, does Lockheed's dedicated control computer MAC 16 play in this triumph? (knowing that the best is yet to come).

MAC, with its admirable 1-microsecond cycle time and priority interrupt system, was the well-considered choice for the #210 EBR Controller. This is the unit, as the reader instantly realizes, that controls the Magnetic Tape Drive, the EBR itself, the Image Processor and the many Microfilm Reader-Printers at remotely located points of use. In short, the entire EBR system.

But modesty precludes a further discussion of MAC 16's virtuosity. If you would know more, hesitate not. Phone for the stirring details. (213) 722-6810. Collect, as you have no doubt anticipated.

Lockheed Electronics

Data Products Division / Los Angeles (213) 722-6810
A Subsidiary of Lockheed Aircraft Corporation

CIRCLE NO. 18 ON INQUIRY CARD

It takes special data terminals to fill special data terminal requirements.

And special data terminals are our specialty.

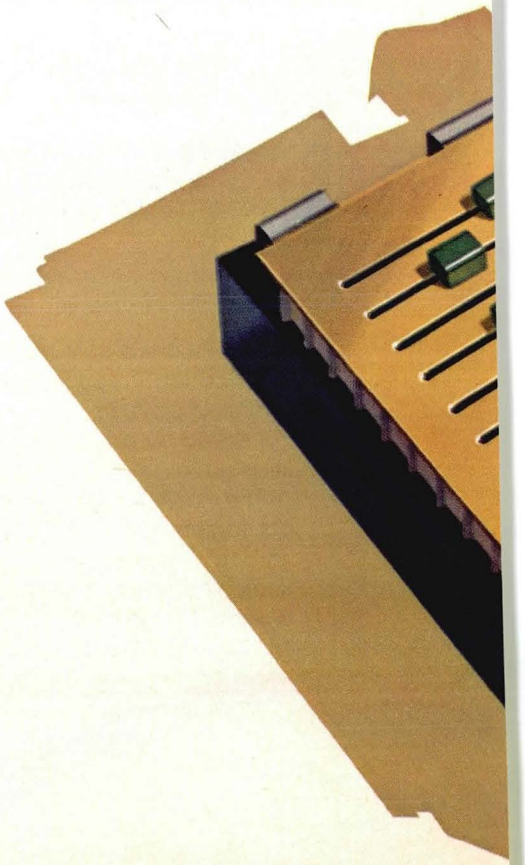
Since we make most of the components that go into data terminals anyway, we can design and make the whole terminal, to meet your custom requirements.

And you'll be happy to hear that our typical turnaround for a prototype is normally less than four months.

If you prefer to put your terminal together yourself, we can supply you with do-it-yourself components such as card readers, switches, scanners, logic, indicator lights and all the connectors you'll ever need.

But you'll save time and money if you let us do the whole thing. And we'll treat it as special as you would.

For more data on our data terminals, write to
AMP Incorporated, Harrisburg, Pa. 17105



AMP
INCORPORATED

Manufacturing and Direct Sales Facilities in: Australia, Canada, France, Great Britain, Holland, Italy, Japan, Mexico, Puerto Rico, Spain, Sweden, United States and West Germany.

Job Cost Recorder

- Provides input from: Badge Card, Tab Card, Slide Switches and Rotary Matrix Switches
- 10 or 11 level ASCI output +5 −0 level
- ASR-33 compatible
- Output data rates from 10 characters per second to 500 CPS
- Lamps to indicate reject, repeat, error, standby
- Case designed to your specifications

Dial-up Inquiry Terminal

- Useful for credit inquiry and data reporting
- Automatic dialing of computer telephone number
- Computer answer-back lamp
- Provides 12 digit inquiry number
- Three answer-back lamps can indicate
  valid credit,
  do not grant credit, repeat information
- Case designed to your specifications

TIME-SHARING SERVICES—Region 1 . . . . Cont'd

COMPANY	On-Line Systems	National CSS	Philco-Ford	Princeton Time-Sharing Services	Programs & Analysis	Proprietary Computer Systems	Rapidata
REGION 1 Area Serviced	Mid Atlantic	Mid Atlantic Ct, Ma Que	NJ, Pa	Mid Atlantic Ct, Ma	Ma, RI	Ma NY, Pa	New England Mid Atlantic
Local Offices	Pitts (c) NYC (m), Phil (m) Buffalo (m)	Stamford, Ct (c) NYC (m), Bos (m) Phil (m), Mont (m) Rochest(m) Eliz(m)	Phil (c)	Princeton (c) Phil (m)	Bos (c) Prov	NYC (m) Bos (m) Phil (m)	Fairfield, NJ (c) NYC (c) Bos (m)
FACILITIES CPU	DEC PDP-10	IBM 360/67 (2)	BUR B5500	IBM 360/65	GE 430	IBM 360/50	GE 437
Size	128K	1.6M bytes	33K @ 48 bits	1.5M bytes	32K words	512K	250K bytes
Core to User Program	60K	1024K	19K	350K	15K	32K	96K
No. Users	45	—	48	60	30	60	35
Response Time (peak/non-peak use)	0/0 sec.	—	—	3/0 sec.	—	—	15/3 sec.
TERMINALS	TTY, CRT, Printers, Plotters	TTY, CRT, Printers, Plotters	TTY, CRT Plotters	TTY, CRT Printers Plotters	TTY	TTY	TTY, CRT Plotters
CHARGES Minimum/Mo.	—	—	$25	$100	$100	—	$10
Connect/Hr. (prime/non-prime)	$10.00	$10.00	$9.00/$7.00	$7.00	$10.00/$5.00	$12.00	$11.00
CPU/Min. (prime/non-prime)	—	$22.80/$9.60	$7.20/$4.80	25¢/sec.	$3.60/$1.80	$6.00	$3.60
Disk Storage/Mo.	$1.00/3200 char.	$20.00/120K bytes	$1.00/1K char[1]	$10.00/100K bytes[1]	85¢/1K char.	$5.00/32K	60¢/1K char.
Tape Storage/Mo.	—	$10.00/hr use	$5.00/tape	—	—	$5.00/tape	$5.00/tape
Other	—	Disk Access $1.00/800K bytes	$25 Initiation	—	—	—	—
FILE STRUCTURE	Random	Index Seql.[1] Random Partitioned	Index Seql. Random	Index Seql. Random, Seql. Partitioned	Index Seql. Random	Index Seql. Random Partitioned	Index Seql. Random
SOFTWARE	BASIC COGO FORTRAN-IV JOSS LISP	BASIC COBOL-ANSI COGO FORTRAN-IV GPSS SIMSCRIPT SNOBOL PL/1	ALGOL BASIC COBOL-61 FORTRAN-IV GPSS	ALGOL COBOL-ANSI FORTRAN-IV GPSS SNOBOL PL/1	BASIC FORTRAN-IV	APL COBOL COGO FORTRAN-IV GPSS PL/1	BASIC COBOL-ANSI COGO FORTRAN-IV
APPLICATION PACKAGES	Business Banking Financial Text Edit Engineering Scientific Program Debug.	Business Banking Financial Text Edit Medical Engineering Scientific Simulation Program Debug.	Business Financial Text Edit Engineering Scientific Simulation Program Debug. Education	Business Financial Accounting Legal Engineering Scientific Simulation Program Debug. Education	Business	Business Banking Financial Accounting Text Edit Printing Legal Engineering Scientific Simulation Program Debug. Education	Business Banking Financial Text Edit Printing Engineering Scientific Program Debug. Education
MULTI-USER ON-LINE DATA BASES	Financial	Optics Library	Financial Economic	Legal (trademarks & chem. patents)	—	—	Financial Economic
OTHER COMMENTS		[1]Multiply Index Direct & Shared File-All Access Methods	[1]First 75K Free	[1]First 1M Free			

TIME-SHARING SERVICES—Region 1 . . . . Cont'd

COMPANY	Realtime Systems	Scientific Time Sharing	Service Bureau	Technology for Information Management	Telcomp		Time Share
REGION 1 Area Serviced	NY, NJ	Mid Atlantic Ct	Mid Atlantic Ct, Ma, RI	NY	Mid Atlantic Ct, Ma, NH, RI, Vt	Mid Atlantic Ct, Ma, NH, RI, Vt	Ct, Ma, NH NJ, NY
Local Offices	NYC (c) Saddle Brk, NJ	NYC (m) Phil (m)	Phil (c) NYC (m), Bos (m) Hart (m)	Albany (m)	Bos (c) NYC (m) E. Orange, NJ (m)	Bos (c) NYC (m) E. Orange, NJ (m)	Hanover, NH (c) Bos (m), Hart (m) Springfld, Ma (m) Durham, NH (m)
FACILITIES CPU	BUR B5500	IBM 360/50	IBM 360/50	GE 430	DEC PDP7/8	DEC PDP-10	HP 2000A
Size	32K words	393K bytes	512K bytes	32K words	24K words	128K words	16K words
Core to User Program	Virtual	32K	114K	20K	"Unlimited"	32K	5K
No. Users	32	60	—	40	32	64	16
Response Time (peak/non-peak use)	5/2 sec.	1 sec.	5/0 sec.	—	—	—	1/<1 sec.
TERMINALS	CRT	TTY	TTY	TTY	TTY, CRT Plotters	TTY, CRT Plotters	TTY
CHARGES Minimum/Mo.	$500	—	$100	—	$100[1]	—	$90.00
Connect/Hr. (prime/non-prime)	$15.00	$12.00	$11.00	$11.00	$12.00[1]	$10.00	$6.00
CPU/Min. (prime/non-prime)	$8.35/$6.65	$6.00	$9.00	—	—	5¢/4K/sec.	—
Disk Storage/Mo.	3¢/1K char.[1]	$10.00/32K bytes	$1.50/3400 bytes	$1.00/1800 char.	—	40/640 char.	$1.00/1240 char.
Tape Storage/Mo.	5¢/file[1]	—	—	—	—	$10.00/tape	—
Other	$100 Initiation	—	15¢/3400 bytes[1]	—	—	DEC tape $5.00/tape	—
FILE STRUCTURE	Random	Random	Seql.	Random	Index Seql.	Index Seql. Random	Random
SOFTWARE	ALGOL BASIC COBOL-ANSI FORTRAN-IV	APL	BASIC FORTRAN-IV PL/1	BASIC FORTRAN-IV	TELCOMP-II	BASIC COGO FORTRAN-IV TELCOMP-II	BASIC
APPLICATION PACKAGES	Business Banking Financial Accounting Engineering Scientific Simulation Program Debug.	Business Financial Accounting Text Edit Engineering Scientific Education	Business Banking Financial Accounting Legal Engineering Scientific Simulation	Business Financial Accounting Engineering Scientific	Business Banking Financial Accounting Engineering Scientific	Business Banking Financial Accounting Text Edit Medical Engineering Scientific Simulation Program Debug.	Business Banking Financial Accounting Printing Education
MULTI-USER ON-LINE DATA BASES	Financial	—	—	Credit	—	—	—
OTHER COMMENTS	[1]per day		[1]per day		[1]Or No Min @ $15.00/hr		

TIME-SHARING SERVICES—Region 1 . . . . Cont'd

COMPANY	Time Sharing Resources	Tymshare	United Computing		University Computing	Virtual Computer Services
REGION 1 Area Serviced	Ct NJ, NY	New England Mid Atlantic Que	Ma NY, Pa	Ma NY, Pa	Mid Atlantic Ma	Mid Atlantic Ma
Local Offices	NYC (c)	NYC (c) Bos (m), Hart (m) Darien, Ct (m) Montreal (m)	NYC (m), Phil (m) Bos, Pitts White Plains	NYC (m), Phil (m) Bos, Pitts White Plains	E. Brunswick NJ (c) NYC (m) Bos (m) Phil (m)	Union, NJ (c) NYC (m), Bos (m) Rochester Allentown & Beth. Pa
FACILITIES CPU	IBM 360/50	XDS 940	CDC 6400	GE 265	UNIVAC 1108 DEC PDP-8 & -9	IBM 360/67
Size	512K bytes[1]	64K @ 24 bits	131K @ 60 bits	16K @ 20 bits	64K words	768K
Core to User Program	114K	32K	250K char.	5.6K	53K	Virtual
No. Users	60	32	—	39	100	—
Response Time (peak/non-peak use)	1 sec.	—	—	—	5/2 sec.	—
TERMINALS	TTY	TTY	TTY, CRT Printers Plotters	TTY Printers	TTY, CRT Printers Plotters	— $10.00/$8.50
CHARGES Minimum/Mo.	—	$80[1]	—	—	—	$500
Connect/Hr. (prime/non-prime)	$11.00	$16.00[1]	$15.00	$8.00	$7.50	—
CPU/Min. (prime/non-prime)	$6.00	4¢	$36.00	$2.40	$20.00	—
Disk Storage/Mo.	$1.50/7200 bytes	$1.00/1K char.	50¢/1280 char.	$1.50/1536 char.	—	—
Tape Storage/Mo.	—	—	—	—	—	—
Other	—	—	—	—	Drum $25.00/1K char.	—
FILE STRUCTURE	Index Seql.	Index Seql. Random	Index Seql. Random	Index Seql. Random	Index Seql. Random Seql.	—
SOFTWARE	APL BASIC FORTRAN-IV PL/1	SUPER BASIC COBOL-ANSI COGO FORTRAN-IV SUPER FORTRAN	ALGOL BASIC COBOL COGO FORTRAN-IV LISP SIMSCRIPT SNOBOL	ALGOL BASIC FORTRAN-IV	ALGOL BASIC COBOL-ANSI COGO FORTRAN-IV GPSS SIMSCRIPT SNOBOL	COBOL FORTRAN-IV SNOBOL PL/1
APPLICATION PACKAGES	Business Financial Accounting Text Edit Printing Engineering Scientific Simulation Education	Business Banking Financial Accounting Text Edit Engineering Scientific Simulation Program Debug.	Business Financial Accounting Text Edit Medical Engineering Scientific Simulation Agriculture	Business Financial Accounting Text Edit Engineering Scientific Education	Business Financial Accounting Text Edit Printing Engineering Scientific Simulation Program Debug.	Financial Accounting Text Edit Medical Scientific Simulation Program Debug.
MULTI-USER ON-LINE DATA BASES	—	Financial Building/Constr.	—	—	—	—
OTHER COMMENTS	[1]1M byte (LCS)	[1]Or $390 Min @ $13.00/hr				

TABLE 2 • REFERENCE LITERATURE

For additional information on Region I Time-Sharing Services described in Table 1, circle the appropriate number listed below on the Reader Service Card.

Company	Reader Service Card Number
Allen-Babcock Computing, Los Angeles, Cal.	200
Applied Computer Time Share, Southfield, Mich.	201
Applied Logic, Princeton, N.J.	202
Axicom Systems, Paramus, N.J.	203
Bowne Time-Sharing, N.Y., N.Y.	204
Burlington Management, Greensboro, N.C.	205
Community Computer, Philadelphia, Pa.	206
Computer Complex, Houston, Texas	207
Computer Dynamics, Boston, Mass.	208
Computer Sciences, El Segundo, Cal.	209
Computer Solutions, East Orange, N.J.	210
Comp/Utility, Boston, Mass.	211
Com-Share, Ann Arbor, Mich.	212
Consolidated Computer, Toronto, Canada	213
Control Data, Minneapolis, Minn.	214
Dialog Computing, Fairfield, Conn.	215
First Data, Waltham, Mass.	216
G.E. Information Services, Bethesda, Md.	217
Honeywell Information Services, Minneapolis, Minn.	218
Interactive Data, Waltham, Mass.	219
Interactive Sciences, Braintree, Mass.	220
Intermac, Rochester, N.Y.	221
International Time Sharing, Minneapolis, Minn.	222
ITT Data Services, Paramus, N.J.	223
Keydata, Watertown, Mass.	224
Leasco Response, Washington, D.C.	225
Mark/Ops, Boston, Mass.	226
McDonnel Automation, St. Louis, Mo.	227
Mega Systems, N.Y., N.Y.	228
Multicomp, Wellesley, Mass.	229
Multiple Access General Computer, Don Mills, Ont.	230
On-Line Systems, Pittsburgh, Pa.	231
National CSS, Stamford, Conn.	232
Philco-Ford, Philadelphia, Pa.	233
Princeton Time-Sharing Services, Princeton, N.J.	234
Programs and Analysis, Burlington, Mass.	235
Proprietary Computer Systems, Van Nuys, Cal.	236
Rapidata, Fairfield, N.J.	237
Realtime Systems, N.Y., N.Y.	238
Scientific Time Sharing, Washington, D.C.	239
Service Bureau, White Plains, N.Y.	240
Technology for Information Management, Albany, N.Y.	241
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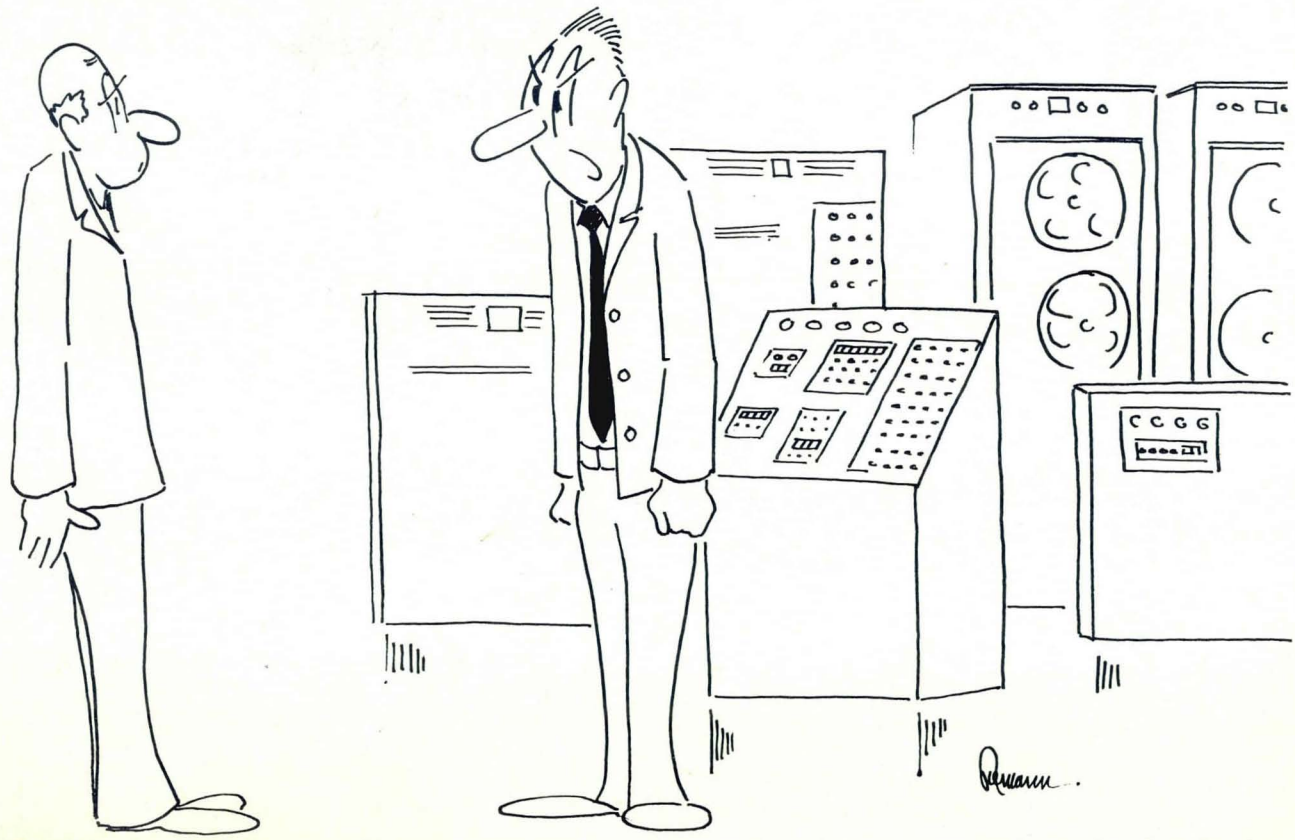

"A 400K core storage, a 500 megabit memory unit with a .1 nanosecond access time and you ask me what the thing does?"

DISK & DRUM DRIVES—PART I

IBM 2311 & 2314 Compatible Disk-Pack

Editor's Note: This Profile on IBM-compatible, removable, disk-pack memories initiates a three-part series to update previous surveys on disk and drum memories published in the December 1968, and February and May 1969 issues of MODERN DATA.

This first part will outline the features of disk drives that are plug-to-plug compatible with the IBM 2311 Disk Storage Drive and the IBM 2314 Direct Access Storage Facility. The second Profile of the series will discuss large scale – over 50 megabits – disk and drum drives, and the third will cover drives that have a storage capacity of under 50 megabits.

INTRODUCTION

The hardware unbundling of peripherals from the systems manufacturer has accelerated during the last two years. The knowledgeable user-buyer, once presented with alternate sources for new, additional, or replacement peripherals, has gone to the independent peripherals manufacturer for equipment compatible with his existing system, but offering advantages in performance and/or price. Even the Federal government, inertia-bound to the policy of buying from the original systems supplier, has been prodded into looking elsewhere for its peripherals.

A specific example of this hardware unbundling involves the IBM 2311 Disk Storage Drive and the IBM 2314 Direct Access Storage Facility, removable disk-pack drives used with the System/360 and /370. A number of independent manufacturers now supply plug-to-plug compatible units for these peripherals which offer better performance through improved technology; others offer drives having the same performance characteristics at lower cost. The basic parameters of the 2311 and 2314, and of compatible units manufactured by independents, are outlined below.

Fig. 1. The Talcott 9311, a plug-to-plug compatible 2311 disk-pack drive, available from Talcott Computer Leasing and manufactured by Singer-Friden.

THE 2311

The 2311 Disk Storage Drive is designed to operate with the System/360. The drive stores data on one 1316 Disk Pack, utilizing the ten inside surfaces of the six disks contained in the removable pack. Data is accessed via a comb-like mechanism of ten vertically aligned heads – one head per disk surface – and is transferred at the rate of 156K bytes per second.

Three models of the 2311 are provided by IBM: the 2311 Model 1, which is used on System/360 Models 25 and up; and the 2311 Models 11 and 12,

Fig. 2. Century Data's CDS 214 drive and CDS-1014 A controller, plug-to-plug compatibles for the 2318 drive and 2314 controller.

Fig. 3. The DM-312 drive of Ampex, a plug-to-plug compatible for the 2312 drive.

used on the System/360 Model 20.

The 2311 Model 1 stores 7.25 megabytes on a 1316 pack, and has an average access time of 75 milliseconds, with a maximum of 135 milliseconds. Up to eight 2311 Disk Storage Drives, with a total capacity of 58 megabytes, may be controlled by the companion 2841 Storage Control drive controller; the 2841 controller can also control other IBM storage devices (data cells, drums) in single- or multiple-type drive combinations of up to eight.

The 2311 Models 11 and 12 are used with a System/360 Model 20 that has a storage control feature. The Model 11 stores 5.4 megabytes per pack and has an average access time of 75 milliseconds. The Model 12 stores 2.7 megabytes per drive and is accessed in 60 milliseconds. Up to four storage drives can be attached to the 360/20.

THE 2314

The 2314 Direct Access Storage Facility is designed to operate with the System/360 Model 30 and up, and can operate with the new System/370. Three models of the 2314 drives are available: the 2312, a single-spindle (pack) drive; the 2318, a dual-spindle drive; and the 2313, a four-spindle drive. Each 2316 Disk Pack can store 29.17 megabytes, using the twenty inside surfaces of the eleven disk removable pack. Facilities may be configured with from one to nine drives (the ninth being a spare) with a maximum storage capacity of 233.4 megabytes. Average access time is 60 milliseconds, and data is transferred at a rate of 312K bytes per second.

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Over a million bits puts you in our CEX-50 class. It comes in 3-wire. 2½D organization. Words: 16K, 32K or 64K.

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MD 1/71

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Lockheed Electronics Company

Data Products Division 6201 East Randolph Street, Los Angeles, California 90022

CIRCLE NO. 20 ON INQUIRY CARD

TABLE 1 • 2311 PLUG-TO-PLUG COMPATIBLE DISK-PACK DRIVES

COMPANY	MODEL	CAPACITY	AVERAGE ACCESS TIME	PRICE		SERVICING
				Lease	Purchase	
BASF SYSTEMS	111	7.25 Mbytes	30 msec	—	—	option
BRYANT COMPUTER PRODUCTS	1100-1	7.25 Mbytes	75 msec	—	—	option
	1100-2	5.4 Mbytes	75 msec	—	—	option
	1100-3	2.7 Mbytes	60 msec	—	—	option
CALIFORNIA COMPUTER PRODUCTS	CD-1	5.4 Mbytes	30 msec	—	—	standard
CENTURY DATA SYSTEMS	CDS-111	7.25 Mbytes	30 msec	—	—	standard
CONTROL DATA	23111	7.25 Mbytes	55 msec	—	—	—
HITACHI	H-8564I	7.25 Mbytes	75 msec	—	—	—
IBM	2311-1	7.25 Mbytes	75 msec	$570	$24,700	option
	2311-11	5.4 Mbytes	75 msec	$570	$24,700	option
	2311-12	2.7 Mbytes	60 msec	$350	$21,600	option
INFORMATION STORAGE SYSTEMS	701	7.25 Mbytes	30 msec	—	$12,900	standard
MARSHALL DATA SYSTEMS	M2500	7.25 Mbytes	48 msec	$495	$12,000	standard
MEMOREX	630	7.25 Mbytes	50 msec	$475	$12,000	standard
	620	5.4 Mbytes	50 msec	$415	$11,500	standard
PERIPHERALS GENERAL	711	7.25 Mbytes	75 msec	—	—	—
POTTER INSTRUMENT	DD4311	7.25 Mbytes	55 msec	$450	$18,100	standard
TALCOTT COMPUTER & SINGER-FRIDEN	9311	7.25 Mbytes	73 msec	$400	$12,000	opt.-$54/mo
	9311/11	5.4 Mbytes	73 msec	$400	—	—
TELEX COMPUTER PRODUCTS	5311	7.25 Mbytes	30 msec	$525	$19,400	standard
TRACOR DATA SYSTEMS	711	7.25 Mbytes	75 msec	$395	$9,500	standard

PLUG-TO-PLUG COMPATIBLES

Tables 1 and 2 outline the major parameters of the 2311 and 2314, and their plug-to-plug compatible equivalents. The compatible drives will operate under the same software as the 2311 and 2314; such software may also be supplied by the compatible drive manufacturer for present IBM systems users that do not have disk systems, or for users that are incorporating such disk drives on an OEM basis.

The advantage — besides savings — gained by going to plug-to-plug compatible disk systems is in a decrease in average access time. The IBM 2311 has an average access time of 75 milliseconds; some compatible manufacturers cite times of from 50 to 30 milliseconds. A similar decrease of from 60 milliseconds to 30 milliseconds can also be gained by using some 2314 compatibles.

For additional information on plug-to-plug compatible 2311 and 2314 disk drives listed in Tables 1 and 2, consult Tables 3 and 4, and circle the appropriate number on the Reader Service Card.

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CIRCLE NO. 21 ON INQUIRY CARD

TABLE 2 • 2314 PLUG-TO-PLUG COMPATIBLE DISK-PACK DRIVES & CONTROLLERS

COMPANY	MODEL	CAPACITY	AVERAGE ACCESS TIME	CONTROLLER	DRIVE PRICE		CONTROLLER PRICE		SERVICING
					Lease	Purchase	Lease	Purchase	
AMPEX	DM-314	29 Mbytes	32 msec	DC-314	$430	$18,000	$1,250	$50,000	standard
BASF SYSTEMS	114	29 Mbytes	40 msec	1014	—	$17,800	—	$48,500	option
	214	58 Mbytes	40 msec	1014	—	—	—	$48,500	option
CALIFORNIA COMPUTER PRODUCTS	CD-12	29 Mbytes	35 msec	CD-14	—	—	—	—	standard
	CD-22	58 Mbytes	35 msec	CD-14	—	—	—	—	standard
CENTURY DATA SYSTEMS	CDS-114	29 Mbytes	35 msec	CDS-1014	—	—	—	—	standard
	CDS-214	58 Mbytes	35 msec	CDS-1014A	—	—	—	—	standard
CONTROL DATA	CDC-23121	29 Mbytes	35 msec	CDC-23141	$430	$18,500	$865	$39,500	option
HITACHI	H-8577I-1	29 Mbytes	60 msec	H-8577S	—	—	—	—	—
	H-8577I-2	58 Mbytes	60 msec	H-8577S	—	—	—	—	—
	H-8577I-4	117 Mbytes	60 msec	H-8577S	—	—	—	—	—
HONEYWELL	DU 1701	29 Mbytes	30 msec	DC 1714	—	$11,000	—	$54,000	—
IBM	2312	29 Mbytes	60 msec	2314	$535	$24,100	$1,480	$66,800	option
	2318	58 Mbytes	60 msec	2314	$920	$41,600	$1,480	$66,800	option
	2313	117 Mbytes	60 msec	2314	$1,745	$78,800	$1,480	$66,800	option
INFORMATION STORAGE SYSTEMS	714	29 Mbytes	30 msec	728	—	$17,400	—	$50,000	standard
MARSHALL DATA SYSTEMS	M2700	29 Mbytes	30 msec	M2800	$430	$18,000	$1,300	$52,000	standard
MEMOREX	660	29 Mbytes	50 msec	661	$430	$18,000	$1,315	$54,000	standard
PERIPHERALS GENERAL	733	29 Mbytes	60 msec	833	—	—	—	—	—
POTTER INSTRUMENT	DD 4314	29 Mbytes	55 msec	DC 5314	$380	$20,000	—	—	std-$50/mo
TELEX COMPUTER PRODUCTS	5314	29 Mbytes	30 msec	5328	$435	$17,400	$1,305	$53,600	standard
TRACOR DATA SYSTEMS	733	29 Mbytes	60 msec	833	$430	$18,000	—	—	standard

TABLE 3 • REFERENCE LITERATURE
2311 PLUG-TO-PLUG COMPATIBLE DRIVES

For additional information on the 2311 plug-to-plug compatible, removable disk-pack drives listed in Table 1, circle on the Reader Service Card the appropriate number list below.

Company	Reader Service Card Number
BASF Systems, Bedford, Mass.	249
Bryant Computer Products, Walled Lake, Mich.	250
California Computer Products, Anaheim, Cal.	251
Century Data Systems, Anaheim, Cal.	252
Control Data, Minneapolis, Minn.	253
Hitachi, New York, N.Y.	254
Information Storage Systems, Cupertino, Cal.	255
Marshall Data Systems, San Marino, Cal.	256
Memorex, Santa Clara, Cal.	257
Peripherals General, Cheery Hill, N.J.	258
Potter Instrument, Plainview, N.Y.	259
Talcott Computer Leasing, New York, N.Y.	260
Telex Computer Products, Tulsa, Okla.	261
Tracor Data Systems, Austin, Texas	262

TABLE 4 • REFERENCE LITERATURE
2314 PLUG-TO-PLUG COMPATIBLE DRIVES

For additional information on the 2314 plug-to-plug compatible, removable disk-pack drives and drive controllers listed in Table 2, circle on the Reader Service Card the appropriate number listed below.

Company	Reader Service Card Number
Ampex, Culver City, Cal.	263
BASF Systems, Bedford, Mass.	264
California Computer Products, Anaheim, Cal.	265
Century Data Systems, Anaheim, Cal.	266
Control Data, Minneapolis, Minn.	267
Hitachi, New York, N.Y.	268
Honeywell, Needham, Mass.	269
Information Storage Systems, Cupertino, Cal.	270
Marshall Data Systems, San Marino, Cal.	271
Memorex, Santa Clara, Cal.	272
Peripherals General, Cherry Hill, N.J.	273
Potter Instrument, Plainview, N.Y.	274
Telex Computer Products, Tulsa, Okla.	275
Tracor Data System, Austin, Texas	276

"WHAT HATH BABBAGE WROUGHT?" Dept.

MIND-ZAPPING

A new publication for the "with-it" generation recently sent a letter to its charter subscribers which included the following paragraphs:

Because (our) subscription roll is maintained by electronic computer, it is necessary to assign a common expiration date to all subscriptions. This enables us to distribute copies and mail renewal notices to all subscribers at the same time. Therefore, we are writing to inform you that your . . . Charter Subscription must be renewed now.

I repeat, this is the one and only time you will receive this notice. If you do not act now, you will forfeit your . . . Charter Subscriber status forever.

PS – Please be sure to see the back of this page for a list of mind-zapping features coming up in (future issues).

Submitted by: Robert R. Rozko
Seattle, Washington

AUTO-MATE-ION

It had to happen
Sooner or later.
Data processing
Is processing daters.

Submitted by: Daniel John Sobieski
Chicago, Illinois

I'LL BET THEY HAVE WILD PARTIES!

A regional government office was doing an analytical study of individuals under its jurisdiction. The name of each person was punched on a card and the cards were then sorted by sex. The outcome was five decks of cards.

Submitted by: Haward Dubin, Valley Stream, N.Y.

NOW PRAY IT WORKS!

I believe all copies of the herein-mentioned missive have been removed from BB&N bulletin boards, but the story goes that when the Advanced Research Projects Agency wanted to implement a network of computer facilities, the decision was made to provide a number of interconnected small computers to interface with the various types of computers at existing facilities and to process messages amongst them. The Cambridge Mass. firm of Bolt, Beranek, & Newman was awarded the contract to provide this interface. Shortly thereafter they received a telegram from one who was obviously pleased to see his home state garner Federal funds for so worthy a cause:

"Congratulations on receiving ARPA contract for Interfaith Message Processor . . . (Senator) Ted Kennedy"

Submitted by: Thomas R. Meir, The Mitre Corp.
Bedford, Mass.

IMAGINE THE BILL HE'LL GET!

The following message was included on a shipping document received by a customer:

PERM READ ERROR ON SELECTED TAPE. START TO RETRY, START RESET AND START BYPASS

Next appeared a part number and a description of the parts that should have been received. Then the following message:

INPUT TAPE ERROR – DUMP CORE AND CALL PROGRAMMER

Needless to say, the customer was not only confused – but received the wrong parts!

Submitted by: Joel E. Hoffman, Bolton, Conn.

MODERN DATA will pay $10.00 for any computer- or EDP-related item worthy of publishing in our **"WHAT HATH BABBAGE WROUGHT DEPT."** Humorous "information" for consideration may include weird memos or operating instructions, unusually incongruous documentation, and off-beat items of a general nature (for review by our off-beat editors). Send all submissions to:

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Entries are the property of **MODERN DATA.**

OPTICAL READERS & OCR

PETER J. GRAY, Dir. Mkt. Div., • Scan Optics E. Hartford, Conn.

With the introduction of each new computer generation, faster and more powerful processors provide the EDP user with more computer capability for his dollar; high-speed printers and other output devices generate more information at a greater rate than ever before. This stress on internal processing and output speeds has aggravated the data input problem; increasing volumes of data have to be entered or reentered into EDP systems. Tight schedules, queuing delays, the shortage of keypunch operators, high personnel turnover rates, inaccurate data transcription, and the increasing costs of data entry have plagued many data-processing systems users. Current estimates state that 35% or more of a data system's costs are spent on information input.

Among the alternative data-entry devices such as keypunches, verifiers, key-to-tape, key-to-disk and remote on-line terminals, optical scanners – particularly optical character recognition (OCR) systems – promise to be the best means of direct source data entry to modern data-processing systems. One of the most important differences between OCR and the other input methods is the amount of labor required. The use of optical readers dramatically reduces the clerical task of manually transcribing data into punched cards, paper or magnetic tape, and obviates the need to enter information through a keyboard. Optical readers provide the fastest means of data conversion, with the least potential to introduce errors, and at a lower cost than either the traditional keypunches or the newer key-entry devices.

There are a number of reasons why optical readers are being accepted by EDP users, and why these readers may become the dominant data input method. The productivity of manual key entry methods is limited by human skill levels – despite the introduction of improved keyboard devices; labor costs of keyboard operators are rising, and such work is becoming less attractive. Improvements in capabilities, reliability, speed and cost/performance are helping to make OCR a more widely-accepted method of data entry. The development of improved software, character standardization, and the trend towards fewer restrictions on forms-preparation requirements has also contributed to OCR's increasing acceptance.

This Profile will describe the operation of optical readers, evaluate OCR input vs. conventional key-input devices, and outline the various applications of OCR in business, industry and government. The tables present the more germane characteristics and parameters of optical character, mark and code readers, and list the companies engaged in OCR activities.

Optical scanning is a generic term which includes optical mark, code or bar, and character reading. However, optical scanning is not an accurate term because scanning is only one of the functions of an optical reader. Scanning involves searching a form for marks, bars or characters, and the conversion of the reflected optical impulses to electrical signals. **Recognition** is the process of comparing these signals with matching sets of stored signals in order to determine their identity.

OPTICAL READERS

Optical mark and code readers correlate the position and location of marks, bars, or lines with predefined characters, while **optical characters readers** identify each character by comparing its features or characteristics with those features or characteristics stored in memory. Optical character reading is similar to the reading methods we humans use. When light is placed on a form containing data, we search or scan the form, and the optical image of the characters is reflected on the retina of the eye. These images are transformed into nerve impulses, and transmitted through various logic levels to the visual cortex of the brain. The brain has been programmed through learning to identify and recognize a variety of characters, and put them into context.

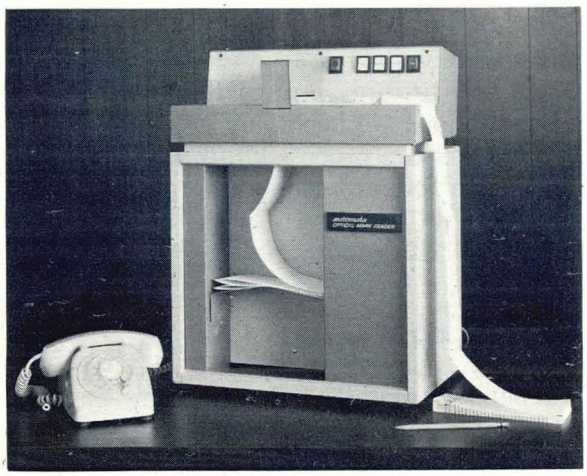
SCANNING TECHNIQUES

Among the scanning techniques used in optical readers are mechanical disk, flying spot, photocell or photoarray, Vidicon, and image dissector.

Mechanical disk scanners use a light source which is reflected from the form being scanned, through a series of lenses, and onto a rotating disk containing multiple apertures which slice each character into segments. Light reflected through these rotating apertures and a fixed aperture plate permits a full character to be scanned for each disk revolution. The fixed aperture plate controls the light and directs it to a photomultiplier for conversion into electrical signals. This method is relatively slow (400-500 characters per second), and subject to mechanical problems.

Flying spot scanners use a CRT-generated spot of light which moves across a form to locate characters and trace their shapes. The intensity of the reflected light is measured and converted by photomultipliers and amplifiers. These scanners are of medium speed (1000-2000 characters per second), and have the ability to do curve tracing and line finding. However, flying spot scanners do not have the resolution capabilities of some other techniques, and they require strict control to prevent entry of ambient light.

In the **photocell scanner,** a light source is used to reflect a character image onto a series of photocells that are used to sample a number of points adding up to a character slice, or to sample a complete character at a time. The photocells generate



The Automata OMR 8421, an optical mark reader which can read pencil marks from fan-fold forms at a rate of 400 marks per second.

signals which are quantized into shades of grey, black, or white. This scanning technique is quite expensive, but scanning speeds of 2400 to 3600 characters per second can be attained.

The **Vidicon** or **TV camera** approach involves scanning characters projected onto the surface of the tube, rather than scanning the form directly. The quantized video signals indicate the degree of blackness or whiteness that exists. This technique is limited by the low number of characters that can be stored on the tube surface.

The **image dissector** method also involves scanning the face of the tube. A high-intensity light source illuminates the read area, reflecting and converging information through a lens and onto the face of the tube. Electrons are activated and directed through an aperture in the tube, where they are measured and multiplied by a photo-electric detector. The image dissector tube is a high-resolution, relatively fast (2000 characters per second) method of scanning.

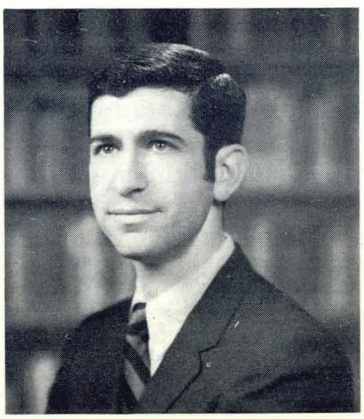
RECOGNITION METHODS

The most commonly used recognition methods are matrix matching, curve tracing, and stroke or feature analysis.

In **matrix matching,** the electronic signals representing the scanned character are stored in a series of shift registers connected to register matrices. Each matrix represents a single character, and is connected to another register containing a voltage representation of the referenced character. The voltage representations in the two registers are compared, and recognition is accomplished. This technique permits the recognition of full alphanumeric fonts and facilitates font changes.

Curve tracing, in conjunction with flying spot scanning, involves following the outlines of a character and recognizing features to identify the character. However, problems are encountered with broken lines and other character imperfections.

Peter J. Gray is Director of Market Development at Scan-Optics, Inc., E. Hartford, Conn., where he is responsible for market planning, applications, software and systems development and implementation, industry marketing, and sales promotion. He was previously employed in marketing and engineering positions at Xerox and IBM, and has a MSc degree from Columbia. He has published articles on computer applications in medicine and marketing.



Stroke or feature analysis uses selected sizes and positions of strokes to identify a character. The form of the character is matched against a truth table representing each reference character. Some scanners incorporate an image enhancement technique prior to recognition, which permits poor-quality characters to be read and reduces the number of rejects and substitutions.

FONTS

The user of optical readers has a wide choice of fonts in either numeric or alphanumeric character sets. Multi-font readers are available, with most manufacturers offering a basic system and additional fonts as options.

In an attempt to standardize, the United States of America Standards Institute, now known as the American National Standard Institute, adopted OCR-A,[1] a stylized font which consists of alphanumeric characters and a set of special symbols. Similarly, the European Computer Manufacturers Association has adopted another stylized font, OCR-B.[1]

The use of standard fonts by optical readers generally provides higher accuracy than non-stylized fonts because each character has been designed to differentiate it from another character. The use of non-stylized fonts may result in increased reject and error rates. Although there are a number of ways to prevent rejects from occuring, substitutions of one character or symbol for another is a more serious problem, and occurs more frequently with non-standard fonts.

The objection to such stylized fonts as OCR-A is that they are not esthetic, but in reality, the characters are as easily read by the human eye as by scanners. Most users require little or no adjustment to OCR-A, and this font is now used more extensively than any other.

OTHER READERS AND FONTS

For applications where permanent records may be required, optical readers are available that use a microfilm camera to record and index forms while they are being read. Readers are also available that can read microfilm after forms have been imaged during a previous step.

Magnetic ink character readers (MICR) do not read data optically, but pass the magnetized ink characters on a form (such as a bank check) past a read head which magnetically senses each character. The font recognized by MICR systems is known as E-13B, which is limited to ten numeric characters and four special symbols. Some optical readers can scan and recognize these magnetic ink characters, in addition to reading other fonts.

FORMS, TRANSPORTS, AND THRUPUT

A key factor to be considered in evaluating optical readers is the paper-handling capability of the transport. The paper transport moves forms from an input feeder through a read area to output stackers. Most transports use a friction or vacuum feeder with rollers and belts.

The speed and efficiency of the transport, together with the speed and capability of scanning and recognition, determine the thruput rate of the optical reader. The thruput rate of a particular form will depend on the size of the form, the number, type and quality of the characters, and the number of lines to be read. Rescanning characters many times and manual character insertion after display reduce the number of forms rejects, but these methods slow down the thruput rate.

Although most users initially install a scanner to process one or two particular applications, they will want to utilize their systems more effectively by adding others types of forms to be read, such as multi-line documents and pages. Multi-function transports are available, and are capable of handling a wide variety of forms sizes, weights, thicknesses, and textures. Forms design specifications and restrictions are becoming less and less severe; some readers can process forms without reference marks, with formatted or unformatted data, with variable data locations, with no aspect ratio (length to width) contraints.

PRICE AND COST RATIOS

Two popular methods of measuring the relative capability of optical readers are the price to performance ratio, and the cost per character or cost per thousand characters processed during a given period of time. Potential users can best determine thruput rates, price to performance ratios, and cost per character processed by testing their forms on various scanners and comparing results.

TYPES OF READERS

OCR systems can be classified by type of input form processed. There are document readers, page readers, journal tape readers, and multi-purpose readers capable of handling a variety of media.

A **document reader** scans one to five lines of data in fixed locations on a document at a single pass. **Page readers** are capable of scanning many

[1] MODERN DATA, Page 56, November, 1970

The Input 80 page reader, an OCR reader produced by Recognition Equipment capable of reading machine-printed or handprinted input at speeds of 3,600 characters per second.

lines of data during a single pass of the form. **Journal tape readers** can process rolls of paper tape generated by adding machines and cash registers.

If the data processing user has a simple, numeric data collection application such as inventory control, or a limited order entry requirement, he might consider using an optical mark reader. Such readers are cheaper than OCR systems, but they restrict the user to a few well-defined applications. Similar restrictions apply to OCR document readers and special-purpose journal tape readers.

For users having a variety of input applications including pages, documents, and sometimes journal tapes, the logical choice should be a **multi-purpose OCR reader** capable of processing a wide range of forms sizes.

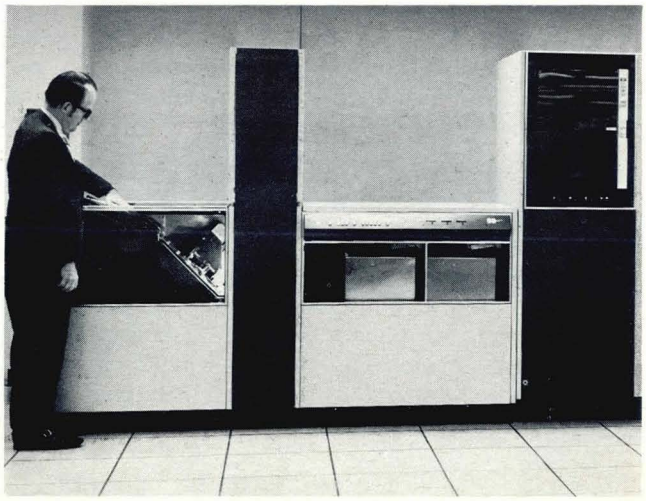
A multi-purpose OCR reader should be capable of reading alphanumeric characters from turnaround documents, such as invoices, that are usually computer generated and returned to the issuer for computer re-entry via OCR. In addition, such a device should be able to read and process handprinted information, and handle typed or printed page-sized forms without major modifications to the equipment. Handprinted characters on forms permit direct data entry from the source generating the information. Applications such as sales orders and inventory reports ideally lend themselves to the recognition of handprinted characters; no typing or retranscription is required, with a consequent improvement in the speed and accuracy of data entry.

ECONOMICS

Optical scanning is typically compared to keypunching and verifying or other keyboard data-entry methods. Tangible dollar savings can be established by calculating the costs of manual keying, including equipment, labor, cards or materials, overhead, benefits, and other factors relative to the performance of the equipment, in terms of accurate quantities of data produced. An average keypunch operator can generate 120 to 130 keystrokes a minute, but the effective thruput rate is reduced to between 60 and 70 characters a minute because verification is generally required. In contrast, an average typist can produce data at a rate of 150 to 160 characters a minute. Even if we assumed the total costs of keypunching and typing were equivalent at $5 an hour, the productivity to cost ratio of typists is more than twice that of keypunch operators. For example, the break even point between keypunching and a $4000 a month OCR system reading typed pages is about 15 keypunches and verifiers. When reading computer-generated turnaround documents, the break even point is about 10 keypunches and verifiers.

These comparisons are not fully indicative of the costs involved. Manual key-entry devices of all kinds are labor intensive devices. The costs of hiring, training, turnover, salary increases, benefits, overtime, and other factors must be accounted for. Most optical readers require one operator, or with high-speed readers, only a part-time operator. There are also a number of intangible savings involved by speeding up the data-processing billing cycle, thereby improving the cash flow. Reduced order processing time means faster revenues and reduced inventories, and improved accuracy of data entry means better operating decisions. Pre-editing and formatting of data also helps save CPU time.

A major benefit of using high-speed data entry devices such as optical readers is the improvement in utilization of installed computer systems. Much EDP time is lost in waiting to process key-gener-



The 20/20 OCR System of Scan Optics, a page/document reader capable of reading a wide variety of fonts and handprint, and 30 lines of 60 characters at 50 pages per minute.

CONTINUED ON PAGE 73

ISRAEL SHEINBERG, Executive Vice Pres. • Recognition Equipment Inc., Dallas, Texas

OCR MARKET FOR THE SEVENTIES

BACKGROUND

Optical character recognition is often referred to as the most promising means of easing the data entry bottleneck. In fact, this prediction has been made so frequently that it has become somewhat of a paradox. It's a paradox now, at the beginning of the 1970's, because there are still only about 1000 OCR installations in the United States, which account for a small two percent of the total data entry volume for all computer systems.

About 80,000 computers are currently installed, with this figure expected to increase substantially throughout the decade, and the market for data entry devices will be greater than ever. OCR manufacturers will capitalize on this opportunity. There are more companies manufacturing and marketing OCR equipment than ever before; about 18 new ones have been formed within the last two years. During this same period, there have been more new OCR products announced than in all the previous years combined.

COST COMPARISONS

One of the most controversial (and least understood) aspects of OCR is its cost. Although initial expenditures for OCR can be substantial, resulting savings can be even more impressive. Even with large-scale million-dollar OCR systems now installed, users are economically justifying OCR—sometimes saving a quarter of a million dollars annually in direct comparison to costs for other means of data entry. This does not even consider savings in other areas, such us the cost of finding and correcting mistakes.

When compared to costs for preparing data through conventional means, the initial investment in optical character recognition immediately becomes a bargain. Keypunching and verifying costs data processors an estimated $3.5 billion annually, of which $3 billion is for personnel costs alone.

It isn't unusual for the cost of input preparation to exceed the cost of the computers themselves. Twelve experienced keypunch operators on eight-hour shifts could produce about 500 hours of work in a week, or 168,000 cards—assuming 40 characters per card and no verification. The cost for this productivity, including salaries, equipment, and materials, would approach $4,000 weekly. One new OCR page-reading system can perform equivalent information preparation in about one hour, and its basic cost for one week's work is only $3,000.

Other illustrations of cost relationships between the various methods of input are numerous. The cost per character example is just one. Keypunching costs about 6 cents to 10 cents per 100 characters, depending on the percent of verification, and about eight cents for key-to-tape devices. Large-scale OCR equipment, such as REI's Input 80 page reader reduces this cost to little more than one cent for 1000 characters. As more technological advances are made, and competition increases, the cost advantages of OCR will be even more evident.

The cost of correcting mistakes that enter the computer—anywhere from 10 cents to $10 each—must also be considered. Generally, keyboard-to-tape units provide no greater capability in error checking, and the accuracy of data input is not greatly improved over keypunch input. Therefore, the user's cost of erroneous data entered into the computer system remains high. Another factor is the handling of rejects. Reading reliability depends on the accuracy of the reading machine and on its ability to reject unreadable data, rather than to make random substitutions.

Computer users in the 1970's will give more consideration to OCR as an integral part of the data processing system and not just as an addition to a system or as a direct substitute for a keypunching or a key-to-tape installation. Many computer users will have such voluminous amounts of paper with data to be entered into a computer, that they will not even consider using keypunching or other methods involving an intermediate transcription of data. The cost of this intermediate step will be prohibitive, and direct reading of source documents will be the only practical answer.

MARKET POTENTIAL

According to some predictions, the OCR market could reach nearly $2 billion by the late 1970's. Others place the figure lower, but OCR growth

will be a result of both the general EDP growth and the replacement of keypunch equipment.

With OCR, the machine adapts to the human environment, rather than the human adapting to the machine by changing humanly recognizable data into some sort of machine code—such as the holes in a punch card.

A good share of OCR's growth will be in areas where a different means of data conversion such as keyboard entry or keypunching is now used. The remainder of its growth will be in cases where the volume of data is just too large to convert any other way. One great potential is the initial conversion of, or general updating of large data files.

APPLICATIONS

Direct reading of source information is OCR's ultimate function, and this is where users benefit most. This is now being accomplished in large-scale batch processing applications including processing oil company credit card tickets, postal transactions, reading information from airline tickets, and many other applications where the original information never has to be retyped or retranscribed for computer use, but is merely forwarded to a centralized data processing location in its original form.

In applications where the information is retyped before reading, such as in bank file updates, the typing merely acts as a substitute for another more traditional type of transcription. While this does have economies and advantages, such as the fact that the material is still humanly readable during every processing step and that typewriters as a means of conversion are cheaper and easier to use than keypunch or key-to-tape equipment, it is not the optimum use of OCR.

One of the uses of OCR that is almost certain to become widespread during the 1970's is the use of low-cost readers by small-to-medium-size companies or in decentralized locations where the volume of data is relatively small, but important, and must be transmitted on- or off-line to central or regional computers.

The newest of these small OCR terminals is designed to operate in ordinary working environments such as offices, factories, and warehouses and for a wide variety of applications including order writing, production and distribution, inventory control, payroll, sales analysis, and accounting. These terminals, if they are to be practical and economical, should be designed so they can be operated by the clerical or route employees, or whoever is responsible for entering the source data. This type of system offers large economies to users, because in most locations that process small amounts of information, someone is nearly always required to manually enter data that's already printed in some form. A viable OCR terminal should eliminate the expense of this extra transcription as well as the additional chance for human error.

HANDPRINTING APPLICATIONS

Since nearly half of all the data to be processed by computers originates as handprinted numbers, most OCR systems, if they are to be truly useful in real environments, should have handprinting reading capabilities. This is necessary to serve applications such as reading report information from utility meter reading and in distribution situations where routemen enter order and inventory information by hand.

Several recent test programs undertaken by OCR manufacturers have shown that the use of handprinted information is practical and that people can adapt to it with little difficulty. A large telephone company underwent a six-month test program where 80 long distance operators completed forms with handprinted information while operating the switchboard, speaking with customers, using a time stamp, keying the call, and monitoring two or three other calls at the same time. The test proved conclusively that people can successfully print numeric characters under less than ideal conditions for long periods of time and have them read successfully by an OCR system. By the program's conclusion, the document reading rate was 92 percent on the first pass with a substitution rate (reading a character incorrectly without rejecting the document, so the operator is unaware the substitution has been made) of 0.2 percent. The reading rate was on target for the test goals, and the substitution rate was 0.3 percent less than required.

The use of handprinted information in OCR applications will take hold within the next few years and will reduce the tools necessary for data input to a common lead pencil.

MACHINE PRINT

OCR's ability to read many different kinds of typewriter and line printer fonts is what makes it workable in a live customer environment and eliminates the need for retranscribing data and for industry standardization.

Government agencies, on all levels from federal to state, are finding they can process the huge quantity of forms and documents needed for data input quickly, accurately, and economically without an intermediate step. Agencies dealing in health, welfare, payroll, motor vehicle and license registration, tax, and many other areas are using OCR now, and many more will turn to OCR in the next decade. A key to OCR's success in these areas is multifont capability, the ability to read many different type styles on an intermixed basis.

SUMMARY

During the 1970's the ratio of OCR systems in use compared to total computer systems will be increased. Published predictions show that by 1975, 20 percent of the estimated 150,000 to 170,000 computers installed will use OCR. This is an estimated annual growth rate of 70 percent—a rate that industry will be hard-pressed to absorb.

Use of key-to-tape input devices will continue to grow as users look for methods to eliminate keypunching. But since key-to-tape is a direct substitution for the keypunching step, users will eventually require a method that allows direct input of source documents. By this time most users will have become sophisticated enough in data processing techniques and economics to look to OCR first.

As users become more familiar with and interested in OCR, service bureaus offering OCR will grow. Customers who are contemplating their own system will be prime service bureau customers, as well as smaller companies and organizations with seasonal peaks, such as mail order firms that have large holiday volumes.

International markets will experience similar growth in OCR utilization. Europe, in an effort to modernize their data processing, has been willing to accept new technologies and to put them to work in such areas as their postal and bank giro systems and large government agencies. As more European organizations redesign their data processing systems, they will incorporate OCR equipment as a basic part of their systems.

Who will share in this highly touted OCR market of the 1970's? Many of the newly formed OCR companies have good technical expertise, but some may not be fully aware of the problems of developing an OCR product that is workable in a live customer environment. The companies who attain the biggest share of this market will be the ones who best respond to customers' needs. They will be the companies, whether large or small, newly formed or established, who recognize the existing opportunities in the marketplace and meet them with equipment that will cost justify the users' applications.

Future technologies will include new methods for input microfilming and faster, even more versatile reading machines. However, the technological need in general is for machines that maintain the performance and reliability of OCR equipment, but with less complexity and at basically lower costs. Technology again, will be worthwhile only if it benefits the user and makes OCR more available to more users.

There will be many new application areas for OCR, such as automated typesetting in the printing industry. The industries that are now leading the way in OCR, such as banks, governments, and the credit card industry, will find OCR as commonly used as the office typewriter.

ated data; this is typical of many installations today, and computer utilization is likely to become even less efficient as users upgrade to larger, more powerful systems. Priority should be given to improving input methods which will, in turn, improve the utilization of main frame systems.

OFF-LINE VS ON-LINE

In evaluating optical scanners, the subject of off-line versus on-line readers must be considered. The on-line CPU costs of a system should be added to the price of the scanner, because some portion of computer time is dedicated to the operation of the reader, rather than to performing other processing tasks.

Less flexibility in scheduling input jobs, and dependency on the main computer are also restricting features of on-line systems. Remote terminal readers should be priced with the costs of communications lines, modems, and other devices included.

SOFTWARE

An important consideration in evaluating and justifying optical readers is the software, systems, and training support provided with the readers. Some vendors offer complete support within the price of the system, while others are partially or fully unbundled.

APPLICATIONS

A wide range of applications are being processed by the 1500 scanners installed today. Such business applications as billing, order entry, file maintenance, and inventory control are common to all types of organizations.

Scanners are reading specific forms pertaining to individual companies and industries. Publishers are using OCR equipment to read subscription notices and lists, premium forms, and coupons. Manufacturers are reading job tickets and time cards, work orders, production and test reports, and payroll lists. Utilities use scanners to process meter cards, repair reports, and change notices. The retail industry uses readers for price tickets, coupons, route sheets, sales slips, and price changes. Banks process mortgage and loan records, payment forms, stock transfers, trust accounts, dividend checks, and other applications. Insurance companies read premium notices, claims forms, medical records, and accident reports. In the area of education, scanning is used extensively for student tests and records. State and federal governments use scanners for tax statements, payment reports, allotment forms, and many other applications.

DATA ENTRY ASPECTS

Data collection, preparation, and recording for optical scanning may be accomplished in a variety of ways. For example, computer-generated turnaround documents such as bills are prepared by line or drum printers. The return stubs of these documents are read back into the OCR system,

NCR's 420-2 optical journal tape reader, capable of reading 52 lines per second from the paper tape outputs of adding machines, cash registers, and accounting equipment.

which, in turn, initiates a file update and new billing cycle. Credit card imprinters are used to generate OCR readable documents for oil companies, retailers, restaurants, and other businesses. Cash registers and adding machines create journal tapes to be optically read by special OCR equipment or multi-function OCR systems with journal tape features.

The office typewriter is commonly used to generate lists or prepare forms for subsequent entry to computers via an optical character reader. Forms may also be generated by hand printing characters or by marking. Sales order slips are filled out at the data source with a date, quantity, description, and prices. These sales orders can be read into the system directly without retranscription. There are a number of other methods of recording data, such as garment tag perforators and notching devices. Another retail application involves point-of-sale scanning devices that automatically read the price or a code from each item purchased, and transmit this information to a computer which calculates taxes and total amounts, and maintains inventory status records.

PARTICULAR APPLICATIONS

The following case studies of users of optical scanners illustrates the power, versatility, and utility of OCR systems.

- *Foremost Foods* is using OCR for routing accounting and sales orders, and saving $350,000 a year.
- *TV Guide* eliminated 13 keypunch and verifier stations, including operators, when it used OCR for subscription fulfillment.
- *McDonnell-Douglas* reduced manufacturing turnaround time, improved systems reliability, and reduced data errors, labor, and equipment costs. Twenty-seven keypunch operators were eliminated, and computer time was reduced, despite an increase in data input workload.
- *The State of Georgia* expects to save $45,000 and months of work by using OCR for direct computer entry of auto registration applications.
- *Imperial Oil* saves $100,000 a year by processing invoices faster and by reducing forms costs.
- *Detroit Ball Bearing Company* reduced its order-inventory cycle time from 62 hours to 45 minutes, using optical scanning rather than punched cards.
- *United Air Lines* saved nearly $25,000 a month in input preparation costs associated with airline tickets and other documents.

CONCLUSION

The selection of an OCR system will depend on the nature and scope of the user's current and potential applications. Many low-cost scanners have severe limitations in their ability to read data reliably, with few rejects and substitutions and at high speeds. On the other hand, some high-priced scanners offer more capabilities than the user requires. With a wide variety of systems to choose from, the user should be able to pick the most versatile equipment available, at a justifiable cost, rather than settle for a machine that can process only one or two immediate applications.

THE TABLES

Information on optical character, mark, and code readers is presented in tables. Table 1 presents data on Page and/or Document OCR readers; Table 2 outlines Optical Mark & Code Readers; and Table 3 gives the characteristics of Optical Journal Tape Readers. Reference literature on these readers may be obtained by consulting Table 4 and using the Reader Service Card.

Table 5 combines a description of Retail OCR, Magnetic Character Readers, and Microfilm OCR with a listing of companies that produce such readers. Reference literature may be obtained by using the Reader Service Card.

TABLE 1 • OPTICAL CHARACTER READERS (Document/Page)

COMPANY	ALLIED COMPUTER SYSTEMS	BURROUGHS	COGNITRONICS	CONTROL DATA	
MODEL	ReaDoc	B9134-1	System/70	915	935
FONTS RECOGNIZED (N)-Numerics Only (S)-Special Symbols (A)-Alphanumerics (UL)-Upper & Lower Case Characters	OCR-A (N) IBM 1428 (N)	OCR-A & B (N) E-13B (N)	OCR-A (A) IBM 1403 (N) Selfcheck (N) NCR-NOF (N) Handprinting (N)	OCR-A (A)	OCR-A (A) IBM 407-1 (N) IBM 1428 (N) Selfcheck 12F (N) Selfcheck 7B (N) Mark
VOCABULARY					
Basic	10 characters	—	44 characters	57 characters	—
Maximum	10 characters	—	44 characters	57 craracters	—
FORM SIZE					
Width	2" to 3½"	2½" to 4½"	2" to 8½"	4" to 12"	2¼" to 8½"
Length	2⅜" to 8½"	6" to 9[illegible]"	3¼" to Unltd.	2½" to 14"[1]	3" to 5½"
READING CAPACITY					
Characters/Line	31	92	76	—	—
Lines/Inch	1	2(1-MICR)	6	6	4
Lines/Pass	1	2	—	—	3
SCANNING RATES					
Machine-Print (characters/sec)	20	2,450	50	370	750
Handprint (characters/sec)	—	—	20	—	—
THRUPUT RATE (forms/min)	8@ 1 line of 20 characters	1,625 @ 1 line of 92 characters	—	—	1,500
OUTPUTS	• Paper Tape or Punched Card (std) [1] • Magnetic Tape (std) [2]	—	• Magnetic Tape (opt-$7,650) • Paper Tape (opt-$5,200)	—	• Magnetic Tape (std) • Paper Tape (std)
CONTROLLER					
Type	DEC PDP 8/L	[1]	DEC PDP 8/L	[2]	CDC 1700
Memory	4 to 8 K @ 12 bits	—	8K @ 12 bits	—	4K @ 16 bits
Disk Drive	Std-32K [2]	—	opt	—	—
SOFTWARE	• Time Share • Self Check Digit • Compare Batching	standard	• Autoform	• General Read & Simulate • Name & Address List Processor	• Document Read & Format
PRICE					
Lease	$450/mo (less CPU) [3]	$1,400/mo	—	$3,975/mo	$5,500/mo
Purchase	$18,000 (less CPU)[4]	$67,200	$33,600	—	—
OTHER FEATURES	• Two Output Stackers • Photocell Scanning • Matrix Matching Recognition	• Dual Read of MICR/OCR Via 2 Read Stations • 4 to 32 Output Stackers	• Roll Feed Transport • Reads Journal Tapes	—	• Three Output Stackers
NOTES	[1]Mark I Model [2]Mark II Model [3]$1,900 for CPU [4]$75,000 for CPU	[1]Any Burroughs Processor	—	[1]Also Fanfold [2]CDC 8092, 8090, 1700 & 3000 Series	—

TABLE 1 • OPTICAL CHARACTER READERS (Document/Page) . . . . . Cont'd

COMPANY	CONTROL DATA (cont'd)	DATA RECOGNITION		ECRM
MODEL	955	700	710	Autoreader
FONTS RECOGNIZED (N)-Numerics Only (S)-Special Symbols (A)-Alphanumerics (UL)-Upper & Lower Case Characters	OCR-A (A, UL) OCR-B (A) IBM 1403 IBM 1428 Selfcheck 12F & 7B NCR-NOF (N,S) E-13B (N) Handprinting	Selfcheck 7B (N)	Selfcheck 7B (N)	Courier 12 (A)[1]
VOCABULARY Basic	—	10 characters	10 characters	—
Maximum	—	—	—	—
FORM SIZE Width	—	2 5/6" to 3½"	3¼"	8½"
Length	—	4"	7⅝"	to 48"
READING CAPACITY Characters/line	—	14	30	75
Lines/Inch	6	2	2	—
Lines/Pass	—	2	2	—
SCANNING RATES Machine-Print (characters/sec)	750	16	—	—
Handprint (characters/sec)	—	—	—	—
THRUPUT RATE (forms/min)	15 @ 30 lines	66 @ 1 line of 14 characters	100 @ 1 line of 30 characters	—
OUTPUTS	—	—	[1]	• Magnetic Tape (opt) • Paper Tape (opt)
CONTROLLER Type	—	In-House Mfg.	In-House Mfg.	DEC PDP 8
Memory	—	—	—	8K @ 12 bits
Disk Drive	—	—	—	—
SOFTWARE	—	—	—	• Typeset • Editing • Selective Scanning
PRICE Lease	$5,500/mo	$2,568/mo	—	$1,970
Purchase	—	$80,000	—	$89,000
OTHER FEATURES	• Two Output Stackers • Reads Journal Tapes	—	• Two Output Stackers	• Vidicon Tube Scanning • Feature Extraction Recognition
NOTES	—	—	[1]Punches Hollerith Code in Source Document	[1]IBM Selectric Typewriter Font

TABLE 1 • OPTICAL CHARACTER READERS (Document/Page) . . . . . Cont'd

COMPANY	FARRINGTON			HONEYWELL	IBM
MODEL	3010	3030	3050	243	1282
FONTS RECOGNIZED (N)-Numerics Only (S)-Special Symbols (A)-Alphanumerics (UL)-Upper & Lower Case Characters	OCR-A (A,S) OCR-B (N,S) IBM 407 (N,S) IBM 1428 (N,S) Selfcheck 7B & 12F (A,S)	OCR-A (A,S) Selfcheck 12L (A,S)	OCR-A (A,S) Selfcheck 12F/12L (A,S)	OCR-A (N,S)	IBM 1428 (N,S) Selfcheck 7B (N) Mark
VOCABULARY Basic	12 characters	62 characters	62 characters	14 characters	13 characters
Maximum	74 characters	123 characters	62 characters	14 characters	—
FORM SIZE Width	2½" to 8½"	4½" to 8½"	4½" to 8½"	3" to 4"	Tab Card
Length	2¾" to 6"	5 3/5" to 14"	5⅝" to 14"	3½" to 8"	Tab Card
READING CAPACITY Characters/Line	60	75	75	70	32
Lines/Inch	6	6	5	1	—
Lines/Pass	5	74	61	1	1
SCANNING RATES Machine-Print (characters/sec)	330	400	400	700	32
Handprint (characters/sec)	—	—	—	—	—
THRUPUT RATE (forms/min)	440 @ 1 line of 21 characters	3.4 @ 74 lines of 75 characters	4 @ 61 lines of 75 characters	600 @ 1 line of 70 characters	200 @ 1 line of 32 characters
OUTPUTS	• Magnetic Tape (std) • Punched Card (opt) • List Printer (std)	• Magnetic Tape (std) • Paper Tape (opt) • Punched Card (opt) • Line Printer (opt)	• Magnetic Tape (std)	• Magnetic Tape (opt) • Paper Tape (opt) • Line Printer (opt)	[1]
CONTROLLER Type	—	Varian 620/i	—	HON 200 Series	—
Memory	—	4 to 32K @ 16 bits	—	4-524K @ 9 bits	—
Disk Drive	—	—	—	opt—3.6 to 280M	—
SOFTWARE	—	standard	—	—	—
PRICE Lease	$3,040/mo	$4,270/mo	$2,730	$1,475	$1,505/mo
Purchase	$124,000	$169,500	$120,000	$67,200	$69,840
OTHER FEATURES	• Three Output Stackers • Mechanical Disk Scanning • Feature Extraction Recognition	• Two Output Stackers • Mechanical Disk Scanning • Feature Extraction Recognition	• Two Output Stackers • Mechanical Disk Scanning • Feature Extraction Recognition	• Three Output Stackers • Photocell Scanning • Stroke Analysis Recognition	• Image Dissector Scanning • Matrix Matching Recognition
NOTES	—	—	—	—	[1]Punches Hollerith Code in Source Document

TABLE 1 • OPTICAL CHARACTER READERS (Document/Page) . . . . . Cont'd

COMPANY	IBM (cont'd)		ICL		INFOTON
MODEL	1287	1288	8401	8692	Challenger
FONTS RECOGNIZED (N)-Numerics Only (S)-Special Symbols (A)-Alphanumerics (UL)-Upper & Lower Case Characters	OCR-A (A, S) IBM 407 (N) IBM 1403 (N) IBM 1428 (N, S) Selfcheck 7B (N) NCR-NOF (N, S) E-13 B (N) Hand printing (N, S)[1]	OCR-A (A, S) Selfcheck 7B (N) Handprinting (N) Gothic (N) Mark	OCR-B (A, S) Mark	OCR-A (A, S) OCR-B (A, S) E-13B (N) CMC 7 (N) Mark	OCR-A (A, S, UL) Handprinting (N, S)
VOCABULARY Basic	57 characters	57 characters	17 characters	16 characters	57 characters
Maximum	—	—	43 characters	48 characters	97 characters
FORM SIZE Width	2¼" to 6"	3" to 9"	3" to 8½"	3" to 4"	1¼" to 12"
Length	3" to 9"	6½" to 14"	4¾" to 13"	6" to 8"	4" to 14"
READING CAPACITY Characters/Line	87	137	63	—	110
Lines/Inch	6	6	—	1	6
Lines/Pass	24 vert./52 horz.	49 vert./82 horz.	4	1	80
SCANNING RATES Machine-Print (characters/sec)	2,000	1,000	550	2,400	3,000
Handprint (characters/sec)	333	333	—	—	3,000
THRUPUT RATE (forms/min)	665 @ 1 line of 20 characters	400 @ 2 lines of 10 characters	—	600	7 @ 40 lines of 110 characters
OUTPUTS	• IBM 360/370	• IBM 360/370	• ICL 1900 • ICL System 4	—	• Magnetic Tape (opt-$10,000)
CONTROLLER Type	IBM 360/370	IBM 360/370	Internal	Internal	optional
Memory	—	—	—	—	—
Disk Drive	—	—	—	—	optional
SOFTWARE	• Programmed in BAL • TOS/DOS/OS	• Programmed in BAL • TOS/DOS/OS	—	—	—
PRICE Lease	$2,715/mo	$4,755/mo	—	—	$1,000/mo
Purchase	$122,220	$223,390	—	—	$35,000
OTHER FEATURES	• Reads Journal Tapes • Three Output Stackers • Flying Spot Scanning • Matrix Matching Recognition	• Two Output Stackers • Flying Spot Scanning • Matrix Matching Recognition	• Three Output Stackers • Photocell Scanning	• Three Output Stackers • Photocell Scanning	• Photocell Scanning
NOTES	[1]Also: Mark Sense; Gothic (N)	—	—	—	—

TABLE 1 • OPTICAL CHARACTER READERS (Document/Page) . . . . . Cont'd

COMPANY	OCR SYSTEMS	OPTICAL SCANNING	ORBITAL SYSTEMS	RECOGNITION EQUIPMENT	
MODEL	1000	Op Scan 288	Orbit/1	Input 2	Input 3
FONTS RECOGNIZED (N)-Numerics Only (S)-Special Symbols (A)-Alphanumerics (UL)-Upper & Lower Case Characters	OCR-A & B (A, S) IBM 407 (N) IBM 1428 (A, S) Selfcheck 7B (N) Handprinting (A) Mark	OCR-A (A) Handprinting (N)	OCR-A (N, S) IBM 1428 (N, S) Selfcheck 12F (N, S) Mark	IBM 407 (A, S) IBM 1403 (A, S) IBM 1428 (A, S) Selfcheck 7B (A) E-13B (N, S) Handprinting (A, S) Gothic (N)	OCR-A & B (A, S) IBM 1403 (N, S) IBM 1428 (N, S) Handprinting (N, S) Mark
VOCABULARY Basic	14 characters	16 characters	14 characters	39 characters[1]	—
Maximum	—	16 characters	14 characters	119 characters[1]	—
FORM SIZE Width	2 3/5" to 8½"	2½" to 4½"	3" to 4"	3¼" to 8½"	3½" to 6"[1]
Length	3½" to 12"	3½" to 8½"	4" to 7½"	3¼" ot 4¾"	4" to 9"[2]
READING CAPACITY Characters/Line	—	80	70	96	45 vert./77 horz.[3]
Lines/Inch	6	1	1	—	3
Lines/Pass	3	1	1	2	24 vert./13 horz.
SCANNING RATES Machine-Print (characters/sec)	1,250	1,000	108	2,400	75
Handprint (characters/sec)	250	520	—	840	40
THRUPUT RATE (forms/min)	544 @ 1 line of 21 characters	900 @ 1 line of 80 characters	130 @ 1 line of 35 characters	600 @ 2 lines of 96 characters	60 @ 1 line
OUTPUTS	• Magnetic Tape (std) • Paper Tape (opt) • Punched Card (opt) • Line Printer (opt)	• Magnetic Tape (std)	• Magnetic Tape (opt)	• Magnetic Tape (std) • Paper Tape (std) • Line Printer (std) • Microfilmer (opt)	• Magnetic Tape (std) • Paper Tape (std) • IBM System 3 Interface
CONTROLLER Type	Varian 620/i	—	—	PC III C	MICRO 800
Memory	4K @ 16 bits	—	—	8K @ 24 bits	4K @ 8 bits
Disk Drive	opt-30K-$6,800	—	—	—	—
SOFTWARE	• Operating • Document Input • Recognition • Utility & Debug	—	—	• Input/Output Control • Monitor • Utility	• Input/Output Control • Edit • Utility • Diagnostic
PRICE Lease	$1,600/mo	$1,505/mo	—	$14,005/mo	$950/mo
Purchase	$56,000	$71,050	$21,800	$547,600	$33,000
OTHER FEATURES	• Three Output Stackers • Photodiode Scanning • Feature Extraction Recognition	• Three Output Stackers • Photocell & Image Dissector Scanning • Matrix Matching Recognition	• Two Output Stackers • Mechanical Disk Scanning • Feature Extraction Recognition	• 3 to 12 Output Stackers • Photocell Scanning • Matrix Matching Recognition	• Two Output Stackers • Mechanical Disk Scanning • Feature Analysis Recognition
NOTES	—	—	—	[1]Plus Handprint	[1]or 2¼" to 6" [2]or 3¾" to 9" [3]85 char. @ 1 line per pass (document)

TABLE 1 • OPTICAL CHARACTER READERS (Document/Page) . . . . . Cont'd

COMPANY	RECOGNITION EQUIPMENT (CONT'D)		SCAN DATA	SCAN OPTICS	UNIVAC
MODEL	Input 80	Electronic Retina	250 & 350	20/20	2703
FONTS RECOGNIZED (N)-Numerics Only (S)-Special Symbols (A)-Alphanumerics (UL)-Upper & Lower Case Characters	Multifont (A, S, UL)[1] Handprinting (N, S) Mark	OCR-A&B (A, S, UL)[1] IBM 407 (A, S) IBM 1403 (A, S) IBM 1428 (A, S) Selfcheck 7B (N, S) E-13B (N, S) Handprinting (A, S) Gothic (N)	OCR-A&B (A, S, UL)[1] IBM 1403 (A, S) Pica 72 (A, S, UL) Handprinting (N, S) Mark	OCR-A (A, S) IBM 407 (N, S) IBM 1403 (A, S) IBM 1428 (N, S) Selfcheck 12F & 7B (N, S) NCR-NOF (N, S) E-13B (N, S) Handprinting (N, S)	OCR-A (N, S) Univac H-14 (N, S) Mark
VOCABULARY					
Basic	40 characters	60 characters	400 characters[1]	74	14
Maximum	360 characters	360 characters	400 characters[1]	210	14
FORM SIZE					
Width	5¾" to 9"	3¼" to 14"	5" to 11"	4½" to 9"	2¾" to 4¼"
Length	4" to 14"	4⅞" to 14"	3" to 14"	3" to 14"	3" to 8¾"
READING CAPACITY					
characters/Line	102	144	80	80	80
Lines/Inch	6	6	6	6	—
Lines/Pass	81	2 or 81	84	76	1
SCANNING RATES					
Machine-Print (characters/sec)	3,600	2,400	800	2,000	1,500
Handprint (characters/sec)	1,200	840	700	1,000	1,050 (mark)
THRUPUT RATE (forms/min)	36 @ 30 lines of 96 characters	24 @ 5 lines of 96 characters	6 @ 60 lines of 80 characters	500 @ 3 lines of 30 characters	600 @ 1 line of 32 characters
OUTPUTS	• Magnetic Tape (std) • Line Printer (std)	• Magnetic Tape (std) • Paper Tape (std) • Line Printer (opt) • Microfilmer (opt)	• Magnetic Tape (std) • Paper Tape (std) • Line Printer (opt)	• Magnetic Tape (std) • Paper Tape (opt) • Line Printer (opt)	• Univac 9000 Series • Magnetic Tape (opt) • Disk File (opt) • Punched Card (opt)
CONTROLLER					
Type	Datacraft 6024	PC I; PC III C	DEC PDP 8/i	HP 2114	Univac 9000 Series
Memory	16K @ 24 bits	8 to 32K @ 24 bits	8K @ 12 bits	4 to 16K @ 16 bits	8K @ 8 bits
Disk Drive	—	—	Option	Option	—
SOFTWARE	• Systems I/O Supervisor • Utility	• Input/Output Control • Reading Control • Utility	• Textscan • Formscan • Format • SWAMI-Self-Teaching Package	• SCAN-Data Capture & Manipulation Package • Utility	• Document to Card/Tape/Disk • Punched Card Read
PRICE					
Lease	$11,895/mo	$13,930/mo	$4,500/mo	$3,100/mo	$1,050
Purchase	$446,000	$500,000	$215,000	$120,000	$42,000
OTHER FEATURES	• Three Output Stackers • Photocell Scanning • Matrix Matching Recognition	• Up to 12 Output Stackers • Ink-Jet Document Printer	• Three Output Stackers • Flying Spot Scanning • Feature Extraction Recognition	• Two Output Stacker Std-Others Opt • Image Disector Scanning • Feature Extraction Recognition	• Three Output Stackers • Photocell Scanning • Matrix Matching Recognition
NOTES	[1]OCR-A & B, IBM, Gothic, etc.	[1]Also Reads Other Printer & Typewriter Fonts	[1]Hardware-Software Unlimited	—	—

TABLE 2 • OPTICAL MARK & CODE READERS

COMPANY	MODEL	FORM SIZE	THRUPUT RATE (forms/min)	OUTPUTS	PRICE	OTHER FEATURES & COMMENTS
ADDRESSOGRAPH MULTIGRAPH	9630 Series (AM Bar Code & Mark)	Tab Card	40 @ 2 lines of 40 marks	• Paper Tape or Punched Card (std)	$610/mo $17,990	• Two Output Stackers • Photocell Scanning
	9650 Series (AM Bar Code)	Tab Card	240 @ 1 line of 60 marks	• Magnetic Tape (std) • Line Printer (opt-$620/mo)	$905/mo $32,035	• Two Output Stackers • Photocell Scanning
AUTOMATA	3600 (Mark)	2" to 6" (w) 3" to 8" (l)	300	• Magnetic Tape (opt) • Paper Tape (opt)	$1,000 (OEM)	• Can Process Intermixed Stack of Variable Length Forms
	8421 (Mark)	3¼" (w) Fan Fold (l)	60	• Magnetic Tape (opt) • Paper Tape (opt)	$1,500 (OEM)	—
CAMBRIDGE INFORMATION SYSTEMS	CIS-103 (Bar Code)	1" to 4" (w) —	20 @ 10 char/form	• Magnetic Tape (opt) • Paper Tape (opt) • Line Printer (opt)	$115/mo $3,495	• Medical Folder Reader
CUMMINS CHICAGO	Scanak 216 (Code, Mark & Perforations)	4¼" to 8¾" (w) 2¼" to 4" (l)	—	• Magnetic Tape (std) • Paper Tape (std) • Listing Printer (std)	$1,000/mo $42,000	• 13 Output Stackers
DATATYPE	DFR-1000 (DF1 & 2 Code)	3" to 8½" (w) 4" to 14" (l)	1 @ 30 lines of 60 marks	• Magnetic Tape (opt) • Paper Tape (opt)	$270/mo $9,450	• Two Output Stackers • Photocell Scanning
DIGITAL RESOURCES	Dataterm-3 (Mark)	6" to 12" (w) 8" to 18" (l)	—	• Magnetic Tape (opt) • Paper Tape (opt) • Data Set (opt)	—	—
HEWLETT PACKARD	2761 (Mark)	Tab Card	80	• Computer Interface • Data Set	$2,750	• Photocell Scanning
ICL	8301 (Mark)	3" to 8½" (w) 4¾" to 13" (l)	150	• Interface to ICL 1900	—	• Three Output Stackers
IDENTICON	Identiscan 100 (Code)	Label	—	—	$6,000	• Can Read at Distances of Several Feet • Warehouse Parcel Marking & Security Badge Applications
MOHAWK DATA	6000 (Mark)	Tab Card	225		—	—
MOTOROLA INSTRUMENTATION	MDR-1000 (Mark)	3¼" to 8½" (w) 4⅞" & up (l)	24	• Magnetic Tape (opt) • Paper Tape (opt) • Data Set (opt)	$142/mo $3,705	• Photocell Scanning
	MDR-2000 & 8000 (Mark)	3¼" to 8½" (w) 4⅞" & up (l)	100 Tab Cards	• Magnetic Tape (opt) • Paper Tape (opt) • Data Set (opt)	$149/mo $3,904	• Photocell Scanning
	MDR-9000 (Mark)	3¼" to 8½" (w) 4⅞" & up (l)	12 Tab Cards	• Magnetic Tape (opt) • Paper Tape (opt) • Data Set (opt)	$144/mo $3,755	• Photocell Scanning
NCS DATA SYSTEMS	Sentry/70 (Mark)	7" to 11" (w) 10" to 17" (l)	100 @ 100 lines of 60 marks	• Magnetic Tape (std) • Line Printer (opt-$850)	$2,300/mo $70,000	• Uses 8K @ 12 bits Processor • Software • Photocell Scanning
OPTICAL SCANNING	Op Scan 50 (Bar Code)	1" to 3⅜" (w) 1½" to 7⅜" (l)	675 @ 5 lines	• Magnetic Tape (std)	$859/mo $39,500	• Two Output Stackers • Photocell Scanning
	Op Scan 70 & 100 (Mark)	8½" (w) 11" (l)	40 @ 62 lines of 48 marks	• Magnetic Tape (std) • Punched Card (std-Op Scan 100)	$673/mo $34,750	• Two Output Stackers • Photocell Scanning
REPUBLIC ELECTRONIC SYSTEMS	500 (Mark)	Tab Card	500	• Interface to IBM 360 & HON 200 • Data Set	—	—
	1502 (Mark)	Tab Card	1,500	• Magnetic Tape (opt) • Interface to IBM 360 & HON 200	$2,200/mo $76,000	• Software • Four Output Stackers • Photocell Scanning
RICCA DATA SYSTEMS	OCR 101 (NRMA Code)	Tickets	1,500	• Magnetic Tape Cartridge	$45/mo $1,500	—
UNITED BUSINESS COMMUNICATIONS	MR-300 (Mark)	Tab Card	300	—	—	—
UNIVERSAL BUSINESS MACHINES	Scantronic (Bar Code)	3" to 6" (w) 5" to 11½" (l)	300	—	$15,000	• 10 to 100 Output Stackers • Photocell Scanning

TABLE 3 • OPTICAL JOURNAL TAPE READERS

COMPANY	FARRINGTON	NCR
MODEL	4040	420-2
FONTS RECOGNIZED (N)-Numerics Only (S)-Special Symbols	OCR-A&B (N, S) IBM 1428 (N, S) Selfcheck 7B & 12F (N, S) NCR-NOF (N, S)	NCR-NOF (N, S)
VOCABULARY Basic	17 characters	16 characters
Maximum	153 characters	16 characters
FORM SIZE Width	1 5/16" to 4 9/16"	1 5/16" to 3 1/4"
SCANNING RATES Machine-Print (characters/sec)	2,000	1,664
OUTPUTS	• Magnetic Tape (std)	• Magnetic Tape (opt-$426/mo) • Paper Tape (opt-$240/mo)
CONTROLLER Type	Varian 620/i	—
Memory	8K @ 16 bits	—
SOFTWARE	Standard	—
PRICE Lease	$3,480/mo	$1,700/mo
Purchase	$141,500	$68,000
OTHER FEATURES	• Flying Spot Scanning • Matrix Matching & Feature Extraction Recognition	• Mechanical Disk Scanning • Matrix Matching Recognition

TABLE 4 • REFERENCE LITERATURE

OCR Document, Page & Tape Readers and Optical Mark & Code Readers

For additional information on the OPTICAL CHARACTER READERS, *the* OPTICAL MARK & CODE READERS, *and the* OPTICAL JOURNAL TAPE READERS *listed in Tables 1, 2 & 3, circle the appropriate number on the Reader Service Card.*

Company	Reader Service Card Number
Addressograph-Multigraph, Cleveland, Ohio	277
Allied Computer Systems, Madison, Conn.	278
Automata, Richland, Wash.	279
Burroughs, Detroit, Mich.	280
Cambridge Information Systems, Cambridge, Mass.	281
Cognitronics, New York, N.Y.	282
Control Data, Minneapolis, Minn.	283
Cummins-Chicago, Chicago, Ill.	284
Data Recognition, Palo Alto, Cal.	285
Datatype, Miami, Fla.	286
Digital Resources, Houston, Texas	287
ECRM, Cambridge, Mass.	288
Farrington, Springfield, Va.	289
Hewlett-Packard, Palo Alto, Cal.	290
Honeywell, Needham, Mass.	291
IBM, White Plains, N.Y.	292
ICL, N.Y., N.Y.	293
Identicon, Waltham, Mass.	294
Infoton, Burlington, Mass.	295
Mohawk Data, Herkimer, N.Y.	296
Motorola Instrumentation, Phoenix, Ariz.	297
NCR, Dayton, Ohio	298
NCS Data Systems, Minneapolis, Minn.	299
OCR Systems, Horsham, Pa.	300
Optical Scanning, Newton, Pa.	301
Orbital Systems, Moorestown, N.J.	302
Recognition Equipment, Dallas, Texas	303
Republic Electronic Systems, El Segundo, Cal.	304
Ricca Data Systems, Santa Ana, Cal.	305
Scan Data, Norristown, Pa.	306
Scan Optics, E. Hartford, Conn.	307
United Business Communications, Shawnee Mission, Kan.	308
Univac, Blue Bell, Pa.	309
Universal Business Machines, Columbia, S.C.	310

TABLE 5 • REFERENCE LITERATURE

Special Readers & Systems

RETAIL (POINT-OF-SALE) OCR

These systems utilize a hand-held gun or pencil scanner to read bar codes on merchandise tickets or labels at check-out counters. Data read may involve item price, tax, and inventory management information; this data is then processed on- and/or off-line to provide sales receipts, and accounting and inventory reports.

For information on RETAIL OCR, *circle the appropriate number on the Reader Service Card.*

Company	Reader Service Card Number
IMS, Los Angeles, Cal.	311
NCR, Dayton, Ohio	312
Transducer Systems, Willow Grove, Pa.	313

OPTICAL MICROFILM CHARACTER READERS

Two manufacturers currently produce systems to read microfilm images — Information International (the Grafix I) and Singer Micrographics (the MS-2000).

These systems are capable of reading a wide variety of type fonts or digitizing graphics from microfilm; they can scan at rates of 2,500 characters per second, and attain thruputs of 3,000 forms per minute. Microfilm input may take the form of roll film or aperture cards, and output may be to a central processor, a magnetic or paper tape drive, or a line or COM printer. The systems utilize their own processors and are software supported.

For information on OPTICAL MICROFILM CHARACTER READERS, *circle the appropriate number on the Reader Service Card.*

Company	Reader Service Card Number
Information International, Los Angeles, Cal.	314
Singer-Micrographics, Sunnyvale, Cal.	315

MAGNETIC CHARACTER READERS

Magnetic character readers are used in banking operations to process and sort checks for demand deposit accounting. These readers recognize, via magnetic ink sensing heads, the human-readble E-13B font of 10 numerics and 4 special symbols; they read at rates of from 600 to 1,600 forms per minute, and sort into from 6 to 18 output stackers.

For information on MAGNETIC CHARACTER READERS, *circle the appropriate number listed below on the Reader Service Card.*

Company	Reader Service Card Number
Honeywell, Needham, Mass.	316
IBM, White Plains, N.Y.	317
Information Technology, Pennsauken, N.J.	318
Lundy Electronics, Glen Head, N.Y.	319
NCR, Dayton, Ohio	320

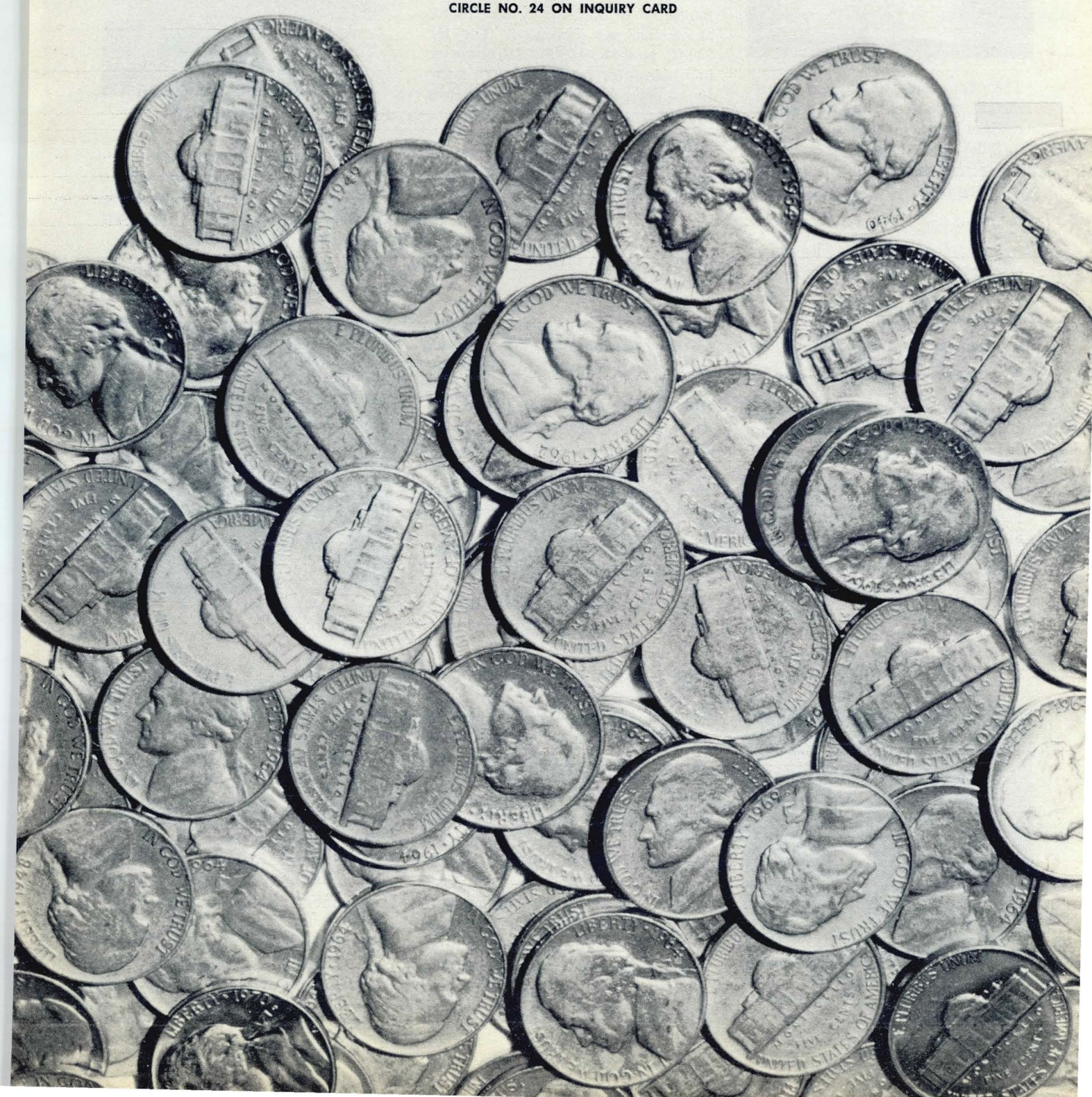
LINE PRINTER.
$2400.

The Centronics Model 101.
It's economical because of the matrix printing and simple design.
It's practical because of the multiple copies, easy interface and communications options.
Just look at the Model 101 as something that acts like a line printer and costs like a teleprinter.
Centronics Data Computer Corp., Hudson, N.H. 03051

centronics

Because you don't want to spend more than you have to.

CIRCLE NO. 24 ON INQUIRY CARD



NEW PRODUCTS

EXPANDED MEMORY MINICOMPUTERS

Development of a high density core memory has made it possible for HP to provide more memory for the same cost and mainframe size. The HP 2116C is a 16-bit, 1.6 microsec machine, available at $20,000 for 8K of core, and expandable to 32K in 8K increments at $10,000 per increment. The HP 2114C is a 4K, 16-bit, 2.0 microsec minicomputer costing $8,500; additional core, in 4K increments, costs $4,500 per increment, and may be expanded to 16K. *Hewlett Packard, Palo Alto, Cal.*

Circle No. 339 on Inquiry Card.

COMMUNICATIONS TERMINAL

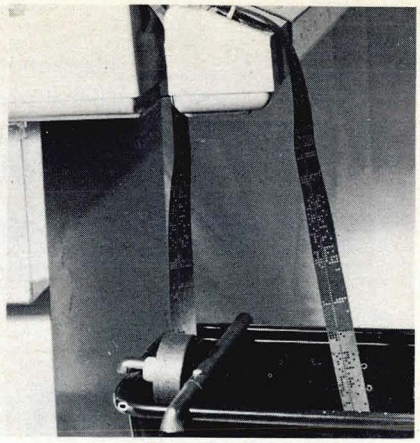
Memorex has introduced a cassette storage communications terminal for source data preparation and entry. The terminal, designated as the 1280, features 180,000 character tape cassette storage, a standard alphanumeric keyboard (with auxiliary numeric keyboard as option), and a 10 to 60 cps printer. A range of editing functions such as character and line insertion or deletion are included. *Memorex, Santa Clara, Cal.*

Circle No. 346 on Inquiry Card.

VOICE COMMAND SYSTEM

The Model 832 system can be "trained" to respond to any individual voice to convert acoustical signals into a digital code. Vocabulary capacity is 32 spoken commands – expandable to 88. The system may be retrained for vocabulary, speaker, or acoustic environment at a rate of 3 sec. per command, and used to enter data, retrieve information, or control machine operation via the human voice. *Scope Electronics, Reston, Va.*

Circle No. 344 on Inquiry Card.



PAPER TAPE TENDER

The low-speed tape unwinder provides unattended paper or mylar tape loading for ASR-33 and -35 Teletype tape readers. *Progeny Products, Greensburg, Ohio*

Circle No. 340 on Inquiry Card.

MICROFILM RETRIEVAL TERMINAL

The Autosearch Microfilm Terminal provides for storage and rapid access to 100,000 pages of information stored on 105mm microfilm rolls. The individual page is retrieved either by keying in a 7-digit address or by a TTY request-computer locate procedure. The Autosearch provides for updating by the use of an auxiliary 16mm film cartridge and has built-in memory to store up to 8 addresses. The basic model sells for $5,000, with the updating feature an additional $2,000. *Morgan Information Systems, Palo Alto, Cal.*

Circle No. 341 on Inquiry Card.

VOICE RESPONSE UNIT

The Model 3100 Voice Response unit is 32-track, hard-mounted, head-per-track, magnetic, analog memory that provides parallel output of 31 pre-recorded spoken words of 500 to 600 millisec duration. The 3100 may be field expanded to a 64 track unit for 63 words, or 31 words and 32 sentences, and requires no scheduled maintenance other than replacement of the drive motor every five years. The device is designed to provide the voice source for computers equipped with a voice response system. *Metrolab, San Diego, Cal.*

Circle No. 354 on Inquiry Card.

ACOUSTIC COUPLERS

Bell 103A-compatible, 300 baud, acoustic couplers for stand-alone or integral applications are available from Beckes Communications Devices. The complete coupler, with power supply, sells for $200, while an OEM kit – coupler, cups, speaker, and microphone less power supply – is priced at $150. *Beckes Communications Devices, Chicago, Ill.*

Circle No. 343 on Inquiry Card.

PDP-11 MASS STORAGE

Three mass storage devices – an industry-compatible magnetic tape unit, a fixed-head disk storage unit, and a removable cartridge disk pack system – are available for the DEC PDP-11. The 10½ inch reel, tape drive comes with either a 7-track (200/556/800 bpi) or 9-track (800 bpi) option, and has a maximum transfer rate of 36K characters/sec. The RS64 fixed-head disk system can store 65.5K, 16-bit words and be accessed in 16.9 millisec. The disk pack drive stores 614.5K words and has an access time of 80 millisec. All units operate on direct memory access cycle steal, so that data is not transferred through the central processor. *Digital Equipment Corporation, Maynard, Mass.*

Circle No. 349 on Inquiry Card.

MINICOMPUTER PRINTER

The 880E – a line printer designed for minicomputer applications – can print an 80 character line on six copy paper at a rate of 400 lines per minute. It can interface, on a plug-to-plug basis, with DEC, HP, Varian, Honeywell, and other minicomputers, and with WE 201 and 212 modems. The 880E sells for $7,800 each, with multiple-order discounts available. *Vogue Instruments, Richmond Hill, N.Y.*

Circle No. 342 on Inquiry Card.

MICROFILM PLOTTER

The microplotter can produce graphics and alphanumerics automatically on microfilm aperture cards or on standard roll film. Digital input information can be fed from paper or magnetic tape, or directly on-line from a computer. Writing speed is 500 characters per sec, with line drawing speed of 330 inches per sec and resolution of 0.002 inches. *Bendix Corp., Ann Arbor, Mich.*

Circle No. 345 on Inquiry Card.

NEW SOFTWARE AND SERVICES

DECISION TABLES PROGRAM

TABTRAN (table translater), a limited entry decision table processor service, reduces the time needed to design, code, and debug a computer program, and also reduces the time needed to execute each program. TABTRAN translates specially formatted decision tables into Cobol source language. The generated source code may be combined with existing Cobol source programs or may take the form of a decision making or logical Cobol section that can be linked with the main line computer program. TABTRAN can be obtained through any of the ten WTSC regional Tele-Computer Service Centers. The cost of the basic TABTRAN service package is $3,200. *Westinghouse Tele-Computer Systems, Pittsburgh, Pa.*

Circle No. 388 on Inquiry Card.

COMMUNICATIONS DESIGN

The Comm-pute time-shared library includes programs for design of WATS arrangements, least-path networks for voice and data, least-cost location of remote multiplexers or concentrators, pricing of communications services, and rate information for private line and exchange services. The routine calculation and information retrieval programs are charged for by minutes of use (typical transaction costs $0.20). The least-cost design programs have a fee-per-run charge in addition to time charges; the fee is $25 for the first run in a month, and $10 for each subsequent run. Comm-pute may be accessed by any 110 bps, ASCII terminal, and is available in 21 cities throughout the country. *Berglund Assoc., Cherry Hill, N.J.*

Circle No. 378 on Inquiry Card.

INVENTORY MANAGEMENT

TRIP (Total Replenishment Inventory Program) is designed for IBM 360/30 and up systems. TRIP can be adapted to inventories of up to 200,000 items, and provides perpetual inventory control. A proprietary formula evaluates material usage, and projects required inventory changes at each usage hit. *Power Computer Systems, Rutherford, N.J.*

Circle No. 384 on Inquiry Card.

ACCOUNTING PACKAGE

INFO-TEM, completely automates the General Ledger and relieves corporate accounting of the task of producing periodic financial statements. The system prepares the balance sheet, profit and loss statement, and produces condensed comparative statements, including current year vs. last year, budget vs. actual, variance analysis, and several other important accounting functons. The program consishs of 35 Cobol programs and can be used on any IBM 360/25-35K core and higher, with either disk or tape. *Computer Radix Corp., New York, N.Y.*

NC TAPE SERVICE

The service, based on the industry standard NC programming language used in the Automatic Programming Tools (APT) system, is provided through DART communications network, linking more than 126 locations to the central computers. Paper tapes describing parts to be machined are prepared with the aid of teletypewriter keyboards and transmitted over DART communication lines in batches at the command of the computer center. Users receive, in addition to tapes, "tool path" drawings via facsimile transmitter. These permit a visual check of general conformity to instructions for producing the particular part. *Allis-Chalmers, Milwaukee, Wisc.*

Circle No. 377 on Inquiry Card.

NEW LITERATURE

I/O ACCESSORIES

A 32-page catalog of I/O accessories, such as paper tape handling devices, mag tape cartridges and cassettes, and ancillary storage units, is available. *In/Opac Div., Numeridex, Chicago, Ill.*

Circle No. 412 on Inquiry Card.

AUTOMATION SYSTEMS

A pocket-size, 44-page booklet describes GA's compatible family of automation computers and systems. *General Automation, Anaheim, Cal.*

Circle No. 418 on Inquiry Card.

TELEPRINTERS

Data on the Inktronic line of high-speed, electrostatic teleprinting terminals is contained in a 12-page book. *Teletype Corp., Skokie, Ill.*

Circle No. 406 on Inquiry Card.

BUFFER STORAGE

The 12-page booklet describes three tape-loop buffers in Wiltek's Digi-Store line. *Wiltek Inc., Wilton, Conn.*

Circle No. 405 on Inquiry Card.

SMALL COMPUTER DISK-PACK DRIVE

A six-page foldout describes the ISS 724 Data Storage System, a disk drive and file control for small computers utilizing a 2316 disk-pack. *Information Storage Systems, Cupertino, Cal.*

Circle No. 407 on Inquiry Card.

POWER SYSTEMS

Literature describing a high performance line of power systems, as well as application engineering assistance for data processing or process control computer systems, instrument or communications installations, is available. *Cyberex, Willoughby, Ohio*

Circle No. 402 on Inquiry Card.

SIMSCRIPT II PLUS

A Simscript II Plus user's manual, describing the features of the language and of a System/360 implementation, is available at a cost of $3.50. *Simulation Associates, Los Angeles, Cal.*

Circle No. 400 on Inquiry Card.

REMOTE TERMINAL

The CP-4 remote batch communications terminal is described in a 20-page booklet. The CP-4 includes a complete line of punched card, paper and mag tape, line and teleprinter, plotter, and other options. *Data Computer, Santa Ana, Cal.*

Circle No. 404 on Inquiry Card.

MINICOMPUTER

The cost, instruction power, programming, and I/O capability of the ND812 minicomputer is discussed in an 18-page brochure. *Nuclear Data, Palatine, Ill.*

Circle No. 411 on Inquiry Card.

DISK CONTROLLERS

The eight-page bulletin describes the use, compatibilities, and specifications of EECO's line of disk memory controllers. *Electronic Engineering Co. of California, Santa Ana, Cal.*

Circle No. 419 on Inquiry Card.

SMALL COMPUTERS

Systems' 72, 82, and 810B solution-oriented small computers are described in a three-page brochure. *Systems Engineering Labs, Ft. Lauderdale, Fla.*

Circle No. 408 on Inquiry Card.

MOD 1 MANUAL

A user's manual for the Interdata Model 1 minicomputer is available. *Interdata, Oceanport, N.J.*

Circle No. 401 on Inquiry Card.

INDEX TO ADVERTISERS

This B will print crisply, cleanly and with no vertical or horizontal misalignment even at 300 lines/minute (132 characters/line) because it's in one of the fonts for the unique Bright Industries' Oscillating Bar Printer.

This B happens to be from a "Caslon" font, but with the Bright Bar Printer you can select fonts you were never able to use before (even Japanese) and change them in the field — in just minutes.

This B comes from a 96-character font including upper and lower case, numerals and symbols galore. It's available in sizes up to one-quarter inch.

This B and all other characters will print longer and for less because the unique oscillating-bar print mechanism is simpler, less expensive and more reliable than drum or chain printers.

This B was brought to you by the Bright BI 1215 Bar Printer. It gives your printout a quality so faultless you could actually write letters with it — and not be ashamed to sign them.

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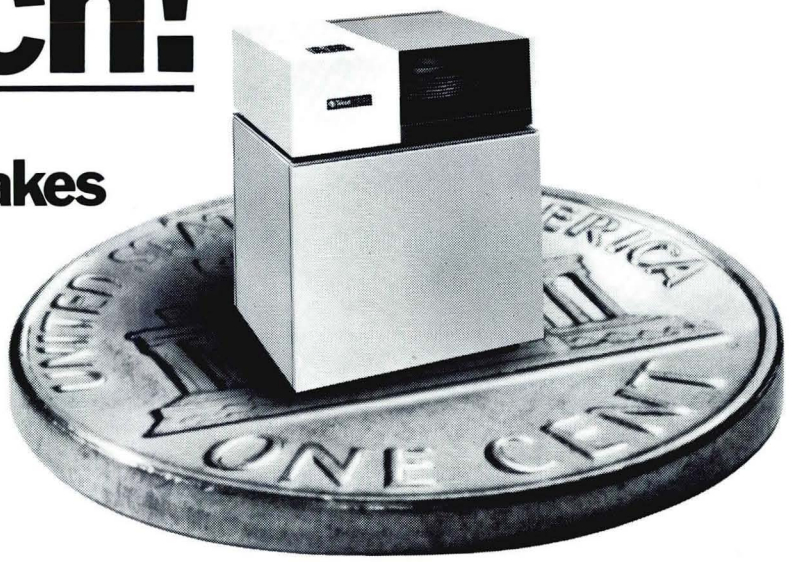
CIRCLE NO. 29 ON INQUIRY CARD

These days, you have to pinch pennies till they say ouch!

That's why Talcott makes EDP stand for "Every Darn Penny."



With business costs so high, you don't have to be a natural-born penny-pincher to want to save dollars. That's where Talcott comes in—with the 9311 Disc Drive for larger systems, and the 9311/11 for smaller ones. Both are made by the Friden Division of Singer—famous for reliable engineering and service, worldwide. And both have proven themselves when it comes to performance as well as saving you cold cash.

You can put five 9311's to work for the usual cost of three 2311's—based on average lease length. That's a saving of 66-2/3%. What's more—there's no charge for using the 9311 on a 24-hour basis.

As for the 9311/11—it matches the capabilities of the 360/20 and offers plug-to-plug compatibility. But it performs the same functions for you at a saving of up to 50%, based on average lease length.

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